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Tank Characterization Report for Single-Shell Tank 241-T-108

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Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-T-108. This report supports the requirements of Tri-Party Agreement Milestone M-44-09.

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Tank Characterization Report for Single-Shell Tank 241-T-108

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EXECUTIVE SUMMARY

This characterization report summarizes the available information on the historical uses and the current status of single-shell tank 241-T-108, and it presents the analytical results of the July 1995 sampling and analysis project. The report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order*, Milestone M-44-09 (Ecology et al. 1994).

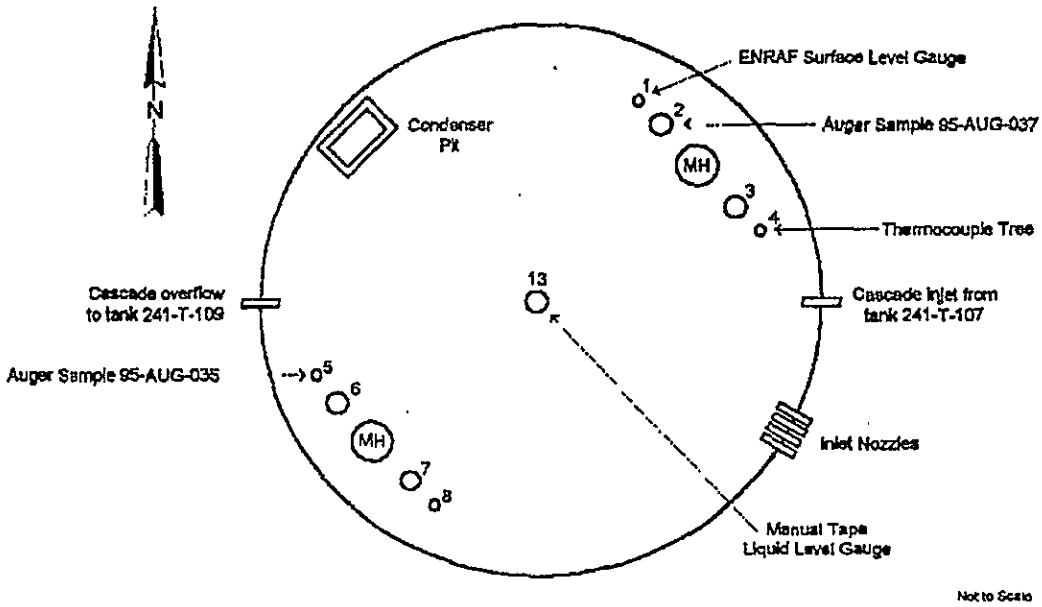
Tank 241-T-108 is the second tank in a three-tank cascade that also includes tanks 241-T-107 and 241-T-109. The tank, which entered service in September 1945, received cascade overflow from tank 241-T-107 until the first quarter of 1946 and again in the first quarter of 1953. The tank has received the following five major types of waste over its service life: bismuth phosphate first-cycle decontamination waste (1C1), tributyl phosphate waste (TBP), evaporator bottoms waste, 242-T Evaporator saltcake (T1SLTCK), and Hanford Laboratory operations waste. The Tank Layer Model (TLM) predicts that the sludge currently in the tank is composed of an upper T1SLTCK waste layer and a bottom layer of 1C1 (Agnew et al. 1995a). Although the waste contains both saltcake and sludge, the waste will be referred to as sludge to be consistent with Hanlon (1996). The tank was classified as an assumed leaker and was removed from service in April 1974. The tank was interim stabilized in November 1978, and intrusion prevention was completed in June 1981.

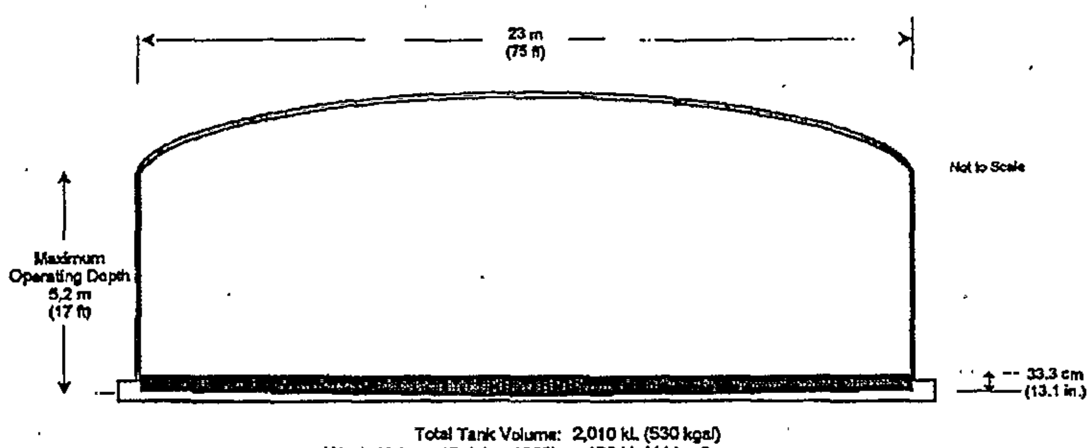
A description of tank 241-T-108 and its status are summarized in Table ES-1 and Figure ES-1. The tank, which has an operating capacity of 2,010 kL (530 kgal), presently contains 170 kL (44 kgal) of waste, composed entirely of sludge (Hanlon 1996).

Table ES-1. Description and Status of Tank 241-T-108.

TANK DESCRIPTION	
Type	Single-shell
Constructed	1943 to 1944
In-service	September 1945
Diameter	23 m (75 ft)
Operating depth	5.2 m (17 ft)
Capacity	2,010 kL (530 kgal)
Bottom shape	Dish
Ventilation	Passive
TANK STATUS	
Waste classification	Noncomplexed
Total waste volume	170 kL (44 kgal)
Sludge volume	170 kL (44 kgal)
Drainable interstitial liquid	0
Waste surface level (January 1991 to January 1996)	31.1 to 41.3 cm (12.25 to 16.25 in.)
Temperature (February 1976 to January 1996)	14 to 27 °C (57 to 81 °F)
Integrity	Assumed leaker
Watch List	None
SAMPLING DATES	
Auger sample	July 19 to July 21, 1995
SERVICE STATUS	
Removed from service	April 1974
Interim stabilized	November 1978
Intrusion prevention completed	June 1981

Figure ES-1. Profile of Tank 241-T-108.





This report summarizes the collection and analysis of two auger samples from the July 1995 sampling event, which was performed to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Babad et al. 1995) and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). The sampling and analyses were performed in accordance with the *Tank 241-T-108 Auger Sampling and Analysis Plan* (Baldwin 1995c). As required by the safety screening data quality objective (DQO), the auger samples were analyzed for moisture content using thermogravimetric analysis (TGA), for fuel content using differential scanning calorimetry (DSC), and for total alpha activity using a fusion digestion and an alpha proportional counter. The DQO also requires a determination of the flammability of the gases in the headspace. To satisfy this requirement, vapor samples were taken prior to auger sampling and the flammability was measured using a combustible gas meter. To meet the requirements of the historical DQO, the auger samples were analyzed for radioisotope content using gamma energy analysis (GEA) and for metals content using inductively coupled plasma spectroscopy (ICP). In addition to the required analyses, selected anion concentrations were measured by ion chromatography (IC) on an opportunistic basis in accordance with Kristofzski (1995).

No exothermic behavior was observed in either auger sample. The TGA weight percent water results for auger 95-AUG-035 were below the safety screening DQO limit of 17 percent, ranging from 0.544 to 4.32 percent and having a mean of 1.69 percent. However, notification of low water content was not made because no exothermic reactions were observed; low water content in itself is not considered an unsafe condition (Fauske et al. 1995). The overall total alpha activity mean was 0.0702 μCi/g, approximately one six hundredth of the safety screening notification limit. Combustible gas meter readings, taken at the time of sampling, revealed that the concentration of flammable gases was 0 percent of the lower flammability limit (WHC 1995). This is far less than the safety screening DQO limit of 25 percent of the lower flammability limit.

Based on the *Historical Tank Content Estimate (HTCE) for the Northwest Quadrant of the Hanford 200 West Area* (Brevick et al. 1995a), the heat load of the tank is 0.0124 kW (42.4 Btu/hr). This estimate should be used with caution since HTCE data has not been validated. This is less than the 11.7 kW (40,000 Btu/hr) boundary between high- and low-heat tanks (Bergmann 1991). The average tank temperature between February 1976 and January 1996 was 19 °C (67 °F), with a minimum of 14 °C (57 °F) and a maximum of 27 °C (81 °F). Surveillance data from February 12, 1996 showed a waste level of 33.3 cm (13.1 in.).

The analyses did not reveal any unusual waste characteristics in tank 241-T-108. The material recovered was dry nitrite/nitrate salts with very low fuel content and low radioactivity. The Historical Program determined that secondary tests were unnecessary except for density, GEA, and metals by ICP (Baldwin 1995b). In addition to the analyses required by the tank characterization plan, analyses were performed on an opportunistic basis for selected anions according to Kristofzske (1995). Table ES-2 provides a summary of the 1995 analytical results.

Table ES-2. Major Analytes and Analytes of Concern.[1]

Metal	Concentration ($\mu g/g$)	RSD (Mean) (%)	Estimated Inventory (kg)
Al	2,290	88.0	915
Bi	605	84.0	242
B	193	80.9	77.1
Ca	177	50.7	70.7
Cr	19.2	69.1	7.67
Fe	6,110	89.3	2,440
Pb	533	81.9	213
Mn	182	51.0	72.7
P	37,400	88.7	14,900
Si	1,500	93.0	599
Na	2.23E+05	10.2	89,100
Sr	21.6	72.4	8.63
S	371	80.0	148
U	1,130	79.3	451
Zn	52.6	52.2	21.0
Zr	10.9	45.4	4.35
Anion	**Concentration ($\mu g/g$)**	**RSD (Mean) (%)**	**Estimated Inventory (kg)**
F^-	10,700	88.7	4,270
NO_2^-	6,210	73.8	2,480
NO_3^-	3.92E+05	73.9	15,700
PO_4^{3}	1.25E+05	79.6	49,900
SO_4^{2}	7,430	80.0	2,970
Radionuclide	**Concentration ($\mu Ci/g$)**	**RSD (Mean) (%)**	**Estimated Inventory (Ci)**
Total alpha	0.0702	35.2	28.0
^{137}Cs	2.00	69.0	799

Notes:

RSD (Mean) = relative standard deviation of the mean

[1]Baldwin (1995b)

An historical evaluation was performed on the analytical results as prescribed in the historical DQO (Simpson and McCain 1995). The historical program targeted tank 241-T-108 because it is predicted to contain a layer of T1 saltcake waste (Agnew et al. 1995a). The fingerprint analytes identified in the historical DQO for T1 saltcake are sodium, nitrate, phosphate, fluoride, and water. Comparisons were made between the analytical results and the DQO-defined concentration levels for these analytes. Results for all fingerprint analytes met the criterion of $\geq$ 10 percent of the concentration level predicted in the historical DQO.

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CONTENTS

CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF TERMS

1C1	first-cycle decontamination from bismuth phosphate process
ANOVA	analysis of variance
Btu/hr	British thermal units per hour
C	Celsius
Ci	curies
cm	centimeter
cm^3	cubic centimeter
DQO	data quality objective
DSC	differential scanning calorimetry
ENRAF.	ENRAF-NONIUS B. V. Corporation
F	Fahrenheit
ft	feet
g	grams
GEA	gamma energy analysis
g/cm^3	grams per cubic centimeter
g/L	grams per liter
g/mL	grams per milliliter
HDW	Hanford Defined Waste
HTCE	Historical Tank Content Estimate
IC	ion chromatography
ICP	inductively coupled plasma spectroscopy
in.	inches
J/g	joules per gram
kg	kilograms
kgal	kilogallons
kL	kiloliters
kW	kilowatts
m	meter
mg	milligrams
mol/L	moles per liter
mR/hr	milliroentgens per hour
ppm	parts per million
RPD	relative percent difference
RSD	relative standard deviation
SAP	Sampling and Analysis Plan
TBP	tributyl phosphate
Temp.	temperature
TGA	thermogravimetric analysis
T1SLTCK	242-T Evaporator Saltcake
TLM	Tank Layer Model

LIST OF TERMS (Continued)

WHC	Westinghouse Hanford Company
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
μCi/g	microcuries per gram
μeq/g	microequivalents per gram
μg/g	micrograms per gram

1.0 INTRODUCTION

This tank characterization report provides an overview of single-shell tank 241-T-108 and its waste components. It gives estimated concentrations and inventories for waste constituents based on the latest sampling and analysis activities and background tank information. Tank 241-T-108 was sampled in July 1995 to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Babad et al. 1995) and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order*, Milestone M-44-09 (Ecology et al. 1994).

Tank 241-T-108 was removed from service in April 1974 and was interim stabilized in November 1978; intrusion prevention was completed in June 1981. Consequently, it is unlikely that the composition of the tank waste will change substantially until pretreatment and retrieval activities commence. The concentration estimates reported in this document reflect the current composition of the waste based on available data.

1.1 PURPOSE

This report summarizes information about the use and the contents of tank 241-T-108. When possible, this information will be used to assess issues associated with safety, operational, environmental, and process development activities. This report also provides a reference point for more detailed information about tank 241-T-108.

1.2 SCOPE

Two auger samples were collected in July 1995. The samples were analyzed to comply with the requirements of the safety screening and historical DQOs. The analyses performed included DSC, TGA, alpha proportional counting, IC, ICP, and GEA. The flammability of the tank headspace was also measured, as required by the safety screening DQO.

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2.0 HISTORICAL TANK INFORMATION

This section describes tank 241-T-108 based on recent surveillance and historical information. The first section details the present condition of the tank. This is followed by discussions of the tank's background, transfer history, and the process sources that contributed to the tank waste, including an estimate of the current contents based on the process history. Events that may be related to tank safety issues, such as potentially hazardous tank contents (ferrocyanide, organics), off-normal operating temperatures (indicative of chemical reactions), or tank damage are included. The final part of this section details the available surveillance data for the tank. Solid and liquid level data are used to determine tank integrity (leaks) and to provide clues to internal activity in the solid layers of the tank (that is, slurry growth from gas evolution with subsequent burping and collapse or shrinking caused by drying). Drywell activity monitoring is noted where anomalies may suggest leaking of the subject tank or nearby tanks. Temperature data are provided to evaluate the heat generating characteristics of the waste.

2.1 TANK STATUS

Tank 241-T-108 contains 170 kL (44 kgal) of noncomplexed waste (Hanlon 1996). Volumes of the various waste phases found in the tank are shown in Table 2-1.

Table 2-1. Summary Tank Contents Status.[1]

Waste Form	Volume kL	(kgal)
Total waste	170	(44)
Supernatant liquid	0	(0)
Drainable interstitial liquid	0	(0)
Drainable liquid remaining	0	(0)
Pumpable liquid remaining	0	(0)
Sludge	170	(44)
Saltcake	0	(0)

Note:

[1]For definitions and calculation methods, refer to Appendix C of Hanlon (1996).

Tank 241-T-108 was classified as an assumed leaker in 1974 and removed from service in April of that year. The tank was administratively interim stabilized in November 1978; intrusion prevention was completed in June 1981. This passively ventilated tank is not on any Watch List.

2.2 TANK DESIGN AND BACKGROUND

The T Tank Farm, which was built in 1943 and 1944, is a first generation tank farm consisting of 12 tanks with a capacity of 2,010 kL (530 kgal) and four tanks with a capacity of 208 kL (55 kgal) tanks. These tanks were designed for nonboiling waste with a maximum fluid temperature of 104 °C (220 °F). Like all first generation tank farms, equipment to monitor and maintain the waste is sparse. A typical tank contains 9 to 11 risers, ranging in size from 0.1 m (4 in.) to 1.1 m (42 in.) in diameter, that provide surface level access to the underground tank. Generally, there is one riser through the center of the tank dome and four or five each on opposite sides of the tank.

Tank 241-T-108 entered service in September 1945 and is second in a three-tank cascading series. These tanks are connected by a 7.6 cm (3 in.) cascade line. The bottom center elevation of tank 241-T-107 is 193.2 m (634 ft), cascading to tank 241-T-108 at 193.0 m (633 ft), cascading to tank 241-T-109 at 192.3 m (631 ft) bottom center elevation. The height of the cascade overflow outlet is approximately 4.78 m (188 in.) from the tank bottom and 60 cm (2 ft) below the top of the steel liner. These single-shell tanks are constructed of 30 cm- (1 ft-) thick reinforced concrete with a .64 cm (0.25 in.) mild carbon steel liner (ASTM A-283 Grade C) on the bottom and sides and a 30.0 cm (1.25 ft) thick domed concrete top. These tanks have a dished bottom with a 1.2 m (4 ft) radius knuckle and a 5.2 m (17 ft) operating depth. The tanks are set on a reinforced concrete foundation. A three-ply cotton fabric waterproofing was applied over the foundation and steel tank. Four coats of primer paint were sprayed on all exposed interior tank surfaces. Tank ceiling domes were covered with three applications of magnesium zinc fluorosilicate wash. Lead flashing was used to protect the joint where the steel liner meets the concrete dome. Asbestos gaskets were used to seal the manholes in the tank dome. The tanks were waterproofed on the sides and top with tar and gunite. Each tank was covered with approximately 2.1 m (7 ft) of overburden.

The surface level is monitored through riser 13 with a manual tape (liquid level reel). In October 1995, an ENRAF gauge was installed in riser 1 to replace a defunct Food Instrument Corporation gauge. Riser 4 contains a thermocouple tree. A plan view illustrating the riser configuration is shown in Figure 2-1. A list of tank 241-T-108 risers showing the size and general use is provided in Table 2-2. This constitutes all installed equipment for tank 241-T-108.

Figure 2-2 shows a tank cross-section of the approximate waste level and a schematic of the tank equipment. Tank 241-T-108 has nine risers. Risers 2, 3, 6, and 7 (300 mm [12 in.] in diameter) and riser 5 (100 mm [4 in.] in diameter) are available. If used as sampling ports, the risers would access opposite sides of the tank.

Four tank inlets are available with one cascade inlet nozzle and one cascade overflow nozzle at approximately 4.8 m (188 in.) respectively from the tank bottom as measured at the tank wall (see Figure 2-1).

Figure 2-1. Riser Configuration for Tank 241-T-108.

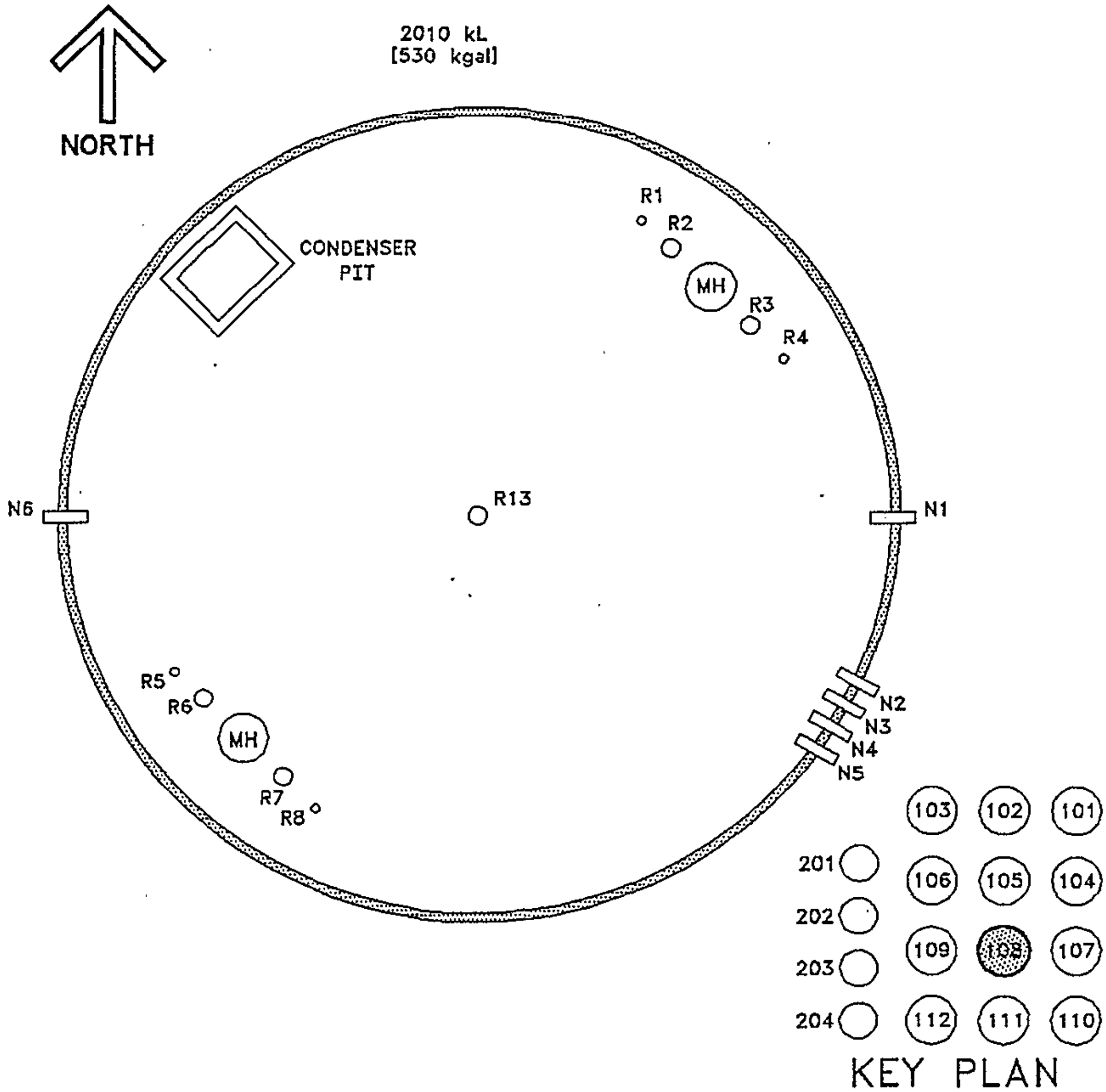


Table 2-2. Tank 241-T-108 Risers.[1,2,3]

Riser Number	Diameter (inches)	Description and Comments
R1	4	ENRAF gauge
R2	12	Observation port
R3	12	Flange with bale
R4	4	Thermocouple tree, manual B-221
R5	4	Flange
R6	12	Flange
R7	12	Flange
R8	4	Breather filter
R13	12	Liquid level reel (BM 12-8-86)
Nozzle Number	**Diameter (inches)**	**Description and Comments**
N1	3	Cascade inlet nozzle
N2	3	Spare nozzle
N3	3	Spare nozzle
N4	3	Spare nozzle
N5	3	Spare nozzle
N6	3	Cascade outlet nozzle

Notes:

[1]Alstad (1993)

[2]Vitro Engineering Corporation (1978)

[3]Hanlon (1996)

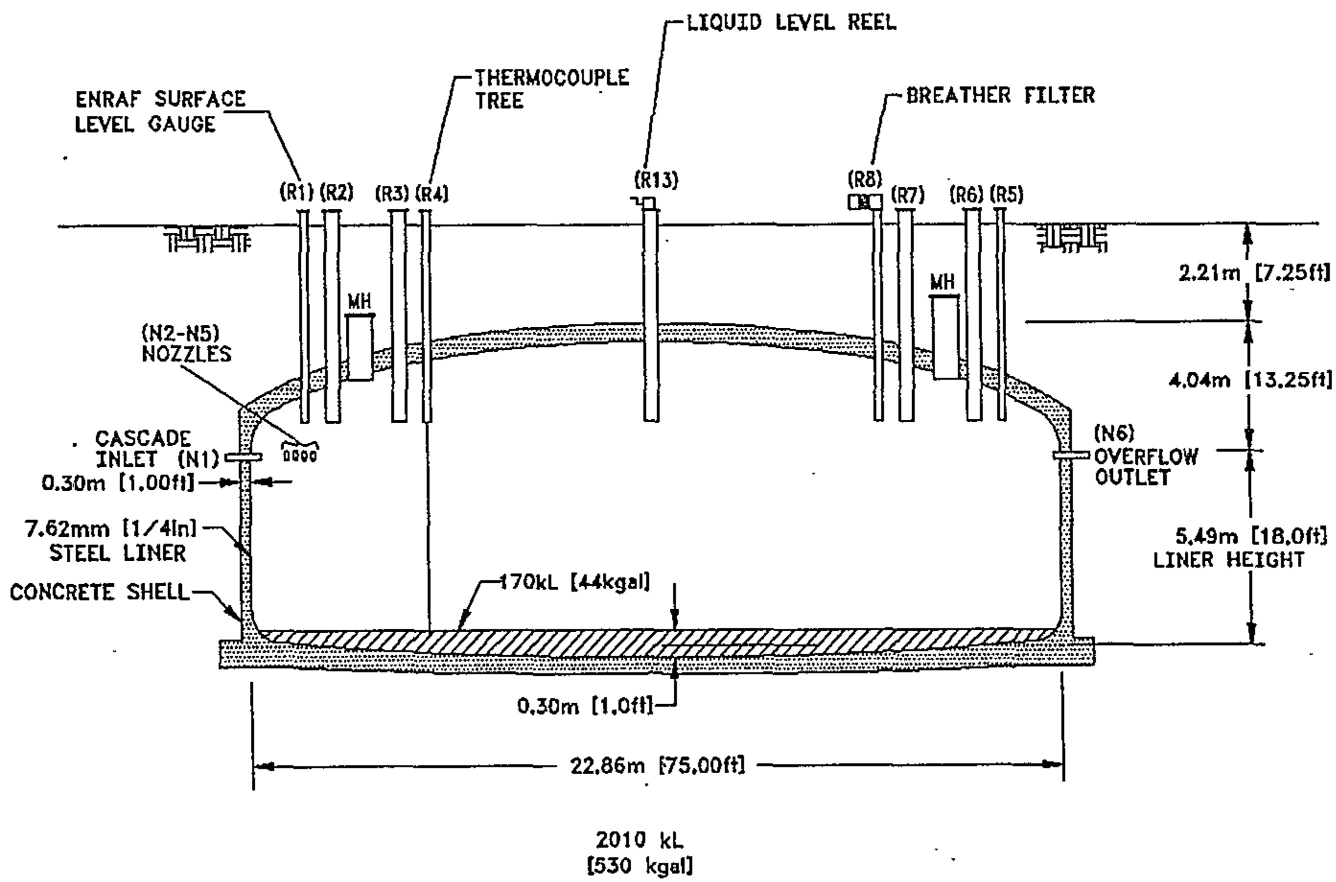


Figure 2-2. Tank 241-T-108 Configuration.

2.3 PROCESS KNOWLEDGE

Section 2.3 describes the transfer history of tank 241-T-108. Section 2.3.1 and Table 2-3 show the major transfers involving tank 241-T-108 and a narrative describing the transfers.

2.3.1 Waste Transfer History

Waste was first added to tank 241-T-108 in September 1945 with the cascade of 1C1 waste (bismuth phosphate first-cycle decontamination waste) from tank 241-T-107 which continued until the first quarter of 1946. During the fourth quarter of 1945 and the first quarter of 1946, the 1C1 supernate cascaded from tank 241-T-108 to tank 241-T-109. Following this activity, the entire cascade of tanks 241-T-107, 241-T-108 and 241-T-109 was declared full.

Supernate, presumably 1C1 waste, was pumped to tank 241-TX-118 during the second and third quarters of 1951. An unknown type of waste, thought to be 1C1 and/or TBP waste, cascaded from tank 241-T-107 to tank 241-T-108 during the fourth quarter of 1952 through the first quarter of 1953. During the same time period, the waste cascaded into tank 241-T-109. Historical records suggest that the waste transferred from tank 241-T-108 was also 1C1 and/or TBP. Supernate was again transferred to tank 241-TX-118 from the second quarter of 1951 until the third quarter of 1953. Historical records suggest that tank 241-T-108 contained 1C1 and TBP waste; therefore, it is assumed that these waste types were added to tank 241-TX-118. During the first quarter of 1954, tank 241-T-108 received supernate, presumably evaporator bottoms waste, from tank 241-TX-117. Saltcake bottoms from the 242-T Evaporator were transferred into tank 241-T-108 during the fourth quarter of 1955 as a result of an evaporator campaign.

During the first quarter of 1967, additional supernate was transferred to tank 241-TX-118. From the second quarter of 1967 until the first quarter of 1968, tank 241-T-108 intermittently received Hanford Laboratory Operations waste. Historical records are unclear as to the original source of this waste. During the first and second quarters of 1973, supernate was pumped from tank 241-T-107. Historical records suggest that the supernate was B Plant low level and/or ion exchange waste. Simultaneously, supernate was transferred to tank 241-T-109. Additional supernate was transferred from tank 241-S-110 during the second quarter of 1974. The last major waste transfer for tank 241-T-108 involved the transfer of supernate to tank 241-T-101 during the first quarter of 1975. Table 2-3 lists some of the major additions of waste to the tank and was generated based on the last available data.

Table 2-3. Summary of Tank 241-T-108 Waste Receipt History.[1]

Transfer Source	Waste Type Received	Time Period	Waste Volume kL	(kgal)
T Plant/cascade from tank 241-T-107	1st cycle decontamination waste from $BiPO_4$ process	1945 to 1953	4,940	(1,305)
Tank 241-TX-117	Supernate transfer from tank 241-TX-117	1954	1,707	(451)
242-T Evaporator	Evaporator bottoms saltcake from 242-T Evaporator	1955	1,934	(511)
Hanford Laboratories	Waste from laboratory operations	1967 to 1968	689	(182)
Tank 241-T-107	Supernate transfer from tank 241-T-107	1973	2,449	(647)

Note:

[1]Agnew et al. (1995b)

2.3.2 Historical Estimation of Tank Contents

The historical tank content estimate (Brevick et al. 1995a) is a prediction of the contents for tank 241-T-108 based on historical transfer data. However, the concentration estimates provided in the HTCE are unvalidated and should be used with caution. The historical data used for the estimate are the Waste Status and Transaction Record Summary (WSTRS) (Agnew et al. 1995b), the Hanford Defined Waste (HDW) list (Agnew 1995), and the Tank Layer Model (Agnew et al. 1995a). The WSTRS is a compilation of available waste transfer and volume status data. The HDW provides the assumed typical compositions for 50 separate wastes types. In most cases, the available data are incomplete thereby reducing the usefulness of the transfer data and the modeling results derived from it. The TLM uses WSTRS data to model the waste deposition processes and HDW data to generate an estimate of the tank contents. These model predictions are considered estimates that require further evaluation using analytical data.

Based on the HTCE and the TLM, tank 241-T-108 contains a top layer of 87 kL (23 kgal) of T1SLTCK waste and a bottom layer of 79 kL (21 kgal) of 1C1 waste from the bismuth phosphate process. Figure 2-3 shows the estimated waste types and volume for the tank layers. The 1C1 layer should contain large amounts of bismuth, sodium, aluminum, nitrate, phosphate, and hydroxide. Chromium, zirconium, fluoride, iron, uranium, nitrite, silicate, and a trace of plutonium will be found as well as small quantities of strontium and cesium. Consequently, this layer will have little activity. The T1SLTCK waste should contain a very large amount of sodium. Nitrate, phosphate, fluoride, and sulfate will be present in significant quantities. Trace quantities of aluminum, iron, bismuth, chromium, uranium, zirconium, and plutonium will be found as well. The presence of cesium and strontium will give this waste layer a correspondingly small activity, but it will be slightly larger than the 1C1 waste activity. The two waste layers are distinguished further because chloride is present in the T1SLTCK waste type but absent from the 1C1 waste and because there is a relative abundance of iron and bismuth found in 1C1 waste compared to T1SLTCK. Table 2-4 shows an estimate of the expected waste constituents and their concentrations.

Figure 2-3. Tank Layer Model for Tank 241-T-108.

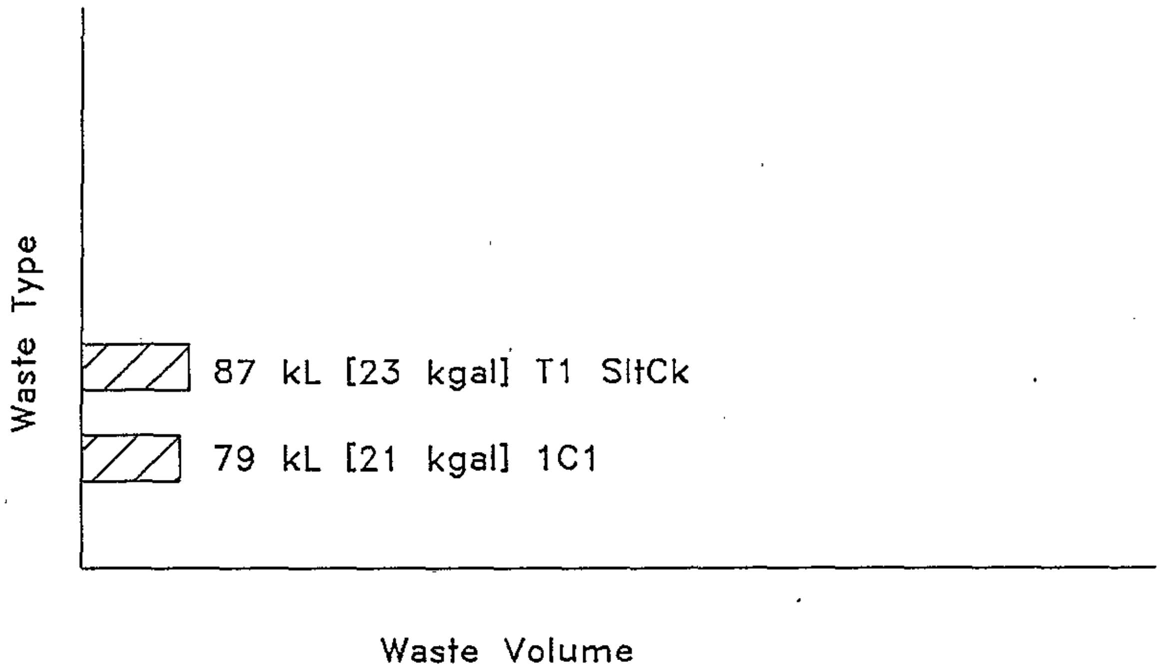


Table 2-4. Tank 241-T-108 Inventory Estimate.[1,2] (2 sheets)

Solids Composite Inventory Estimate			
Physical Properties			
Total solid waste	2.43E+05 kg (44 kgal)		
Heat load	0.0124 kW (42 Btu/hr)		
Bulk density	1.46 (g/cm^3)		
Void fraction	0.618		
Water weight percent	62.2		
Total Organic Carbon weight percent Carbon (wet)	0		
Chemical Constituents	**mol/L**	**ppm**	**kg**
Na^+	7.86	1.24E+05	30,100
Al^{3+}	0.685	12,600	3,080
Fe^{3+} (total Fe)	0.250	9,540	2,320
Cr^{3+}	0.00953	339	82.5
Bi^{3+}	0.0476	6,800	1,660
La^{3+}	0	0	0
Ce^{3+}	0	0	0
Zr (as $ZrO(OH)_2$)	0.0115	717	175
Pb^{2+}	0	0	0
Ni^{2+}	0.0192	769	187
Sr^{2+}	0	0	0
Mn^{4+}	0	0	0
Ca^{2+}	0.104	2,840	692
K^+	0	0	0
OH^-	2.96	34,500	8,390
NO_3^-	1.77	75,100	18,300
NO_2^-	0.153	4,820	1,170
CO_3^{2-}	0.145	5,950	1,450
PO_4^{3-}	1.45	94,000	22,900
SO_4^{2-}	0.358	23,500	5,720
Si (as SiO_3^{2-})	0.116	2,230	543
F^-	0.632	8,210	2,000
Cl^-	0.0374	905	220

Table 2-4. Tank 241-T-108 Inventory Estimate.[1,2] (2 sheets)

Solids Composite Inventory Estimate			
Chemical Constituents (Cont'd)	mol/L	ppm	kg
citrate^{3-}	0	0	0
EDTA^{4-}	0	0	0
HEDTA^{3-}	0	0	0
NTA^{3-}	0	0	0
glycolate^{-}	0	0	0
acetate^{-}	0	0	0
oxalate^{2-}	0	0	0
DBP	0	0	0
NPH	0	0	0
CCl_4	0	0	0
hexone	0	0	0
$Fe(CN)_6^{4-}$	0	0	0
Radiological Constituents	Ci/L	μCi/g	Ci
Pu	---	0.00588	0.0239 (kg)
U	0.00140 (mol/L)	228 (μg/g)	55.6 (kg)
Cs	0.0135	9.25	2,250
Sr	0.00167	1.14	227

Notes:

[1]Brevick et al. (1995a)

[2]The HTCE predictions have not been validated and should be used with caution.

2.4 SURVEILLANCE DATA

Tank 241-T-108 surveillance consists of surface level measurements (liquid and solid), temperature monitoring inside the tank (waste and vapor space), and drywell leak detection monitoring for radioactivity outside of the tank. The data are significant because they provide the basis for determining tank integrity.

Liquid level measurements can indicate whether there is a major leak from a tank. Solid surface level measurements indicate physical changes and the consistency of the solid layers of a tank. Drywells around the tank perimeter may show increased radioactivity caused by leaks near a drywell.

2.4.1 Surface Level Readings

Because tank 241-T-108 is categorized as an assumed leaker, a manual tape is used to monitor the surface level of the waste through riser 13 daily. The leak detection criteria for tank 241-T-108 are an increase or decrease of 5 cm (2 in.) from the baseline value. The manual tape readings range from 31.1 cm (12.25 in.) to 41.3 cm (16.25 in.) from January 1991 to January 1996. A level of 33.3 cm (13.1 in.) was measured on February 12, 1996. Figure 2-4 shows a level history graph of the volume measurements.

Tank 241-T-108 does not have a liquid observation well. Six drywells are identified for this tank. Five of the six drywells exhibited large increases in radiation readings beginning around 1978. The readings peaked within the next one to three years, then slowly receded to near background levels. Initially radioactivity was thought to have originated from tank 241-T-106, but data from two new exploratory wells drilled in 1979 led to the conclusion that the activity was coming from tank 241-T-108. Erratic level readings in the years preceding the radiation increases could suggest that the tank was leaking and receiving liquid from an intrusion.

2.4.2 Internal Tank Temperatures

Tank 241-T-108 has a single thermocouple tree with 11 thermocouples to monitor the waste temperature through riser 4. Thermocouple 1 is 37.0 cm (1.2 ft) from the bottom of the tank. Thermocouples 2 though 9 are spaced at 60.0 cm (2 ft) intervals above thermocouple 1. Thermocouples 10 and 11 are at 1.2 m (4 ft) intervals.

Non-suspect data recorded between February 1976 and January 1996 from the surveillance analysis computer system were available for all thermocouples except thermocouple 1. Thermocouple 1 had data recorded between February 1976 and January 1989. Temperature data for a twelfth thermocouple were available; however, the location of this probe is unknown so the data were not considered in this report. Thermocouple 1 had a large break in data from February 1981 to July 1987. The other thermocouples had several small breaks in temperature data. The small breaks spanned nearly 33 months.

Since 1976, none of the 11 thermocouples were located within the waste. The average tank temperature above the waste was 19 °C (67 °F), the minimum was 14 °C (57 °F), and the maximum was 27 °C (81 °F). Plots of the thermocouple readings are available in Brevick et al. (1995b). Figure 2-5 shows a graph of the weekly high temperature.

Figure 2-4. Tank 241-T-108 Level History.

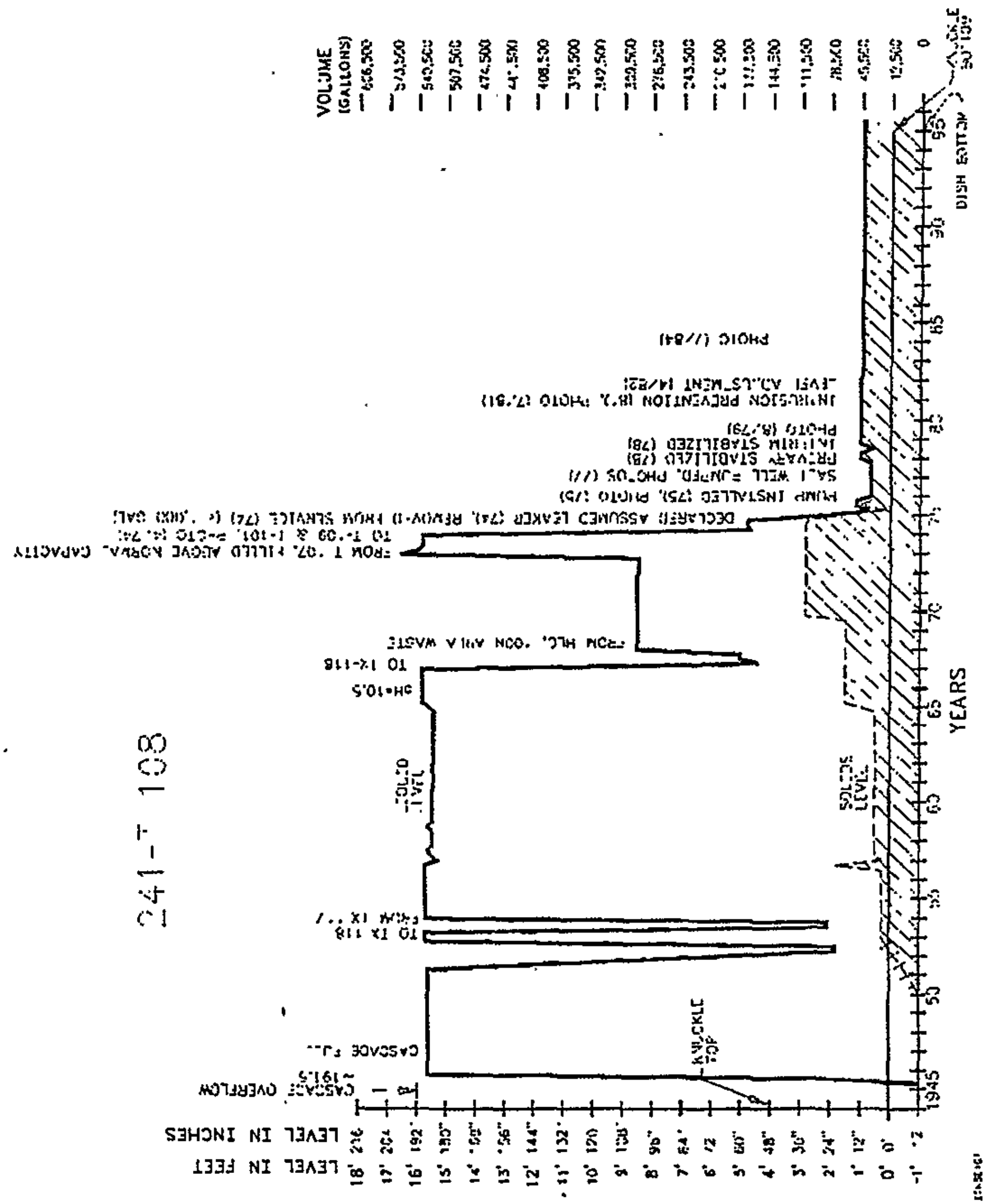
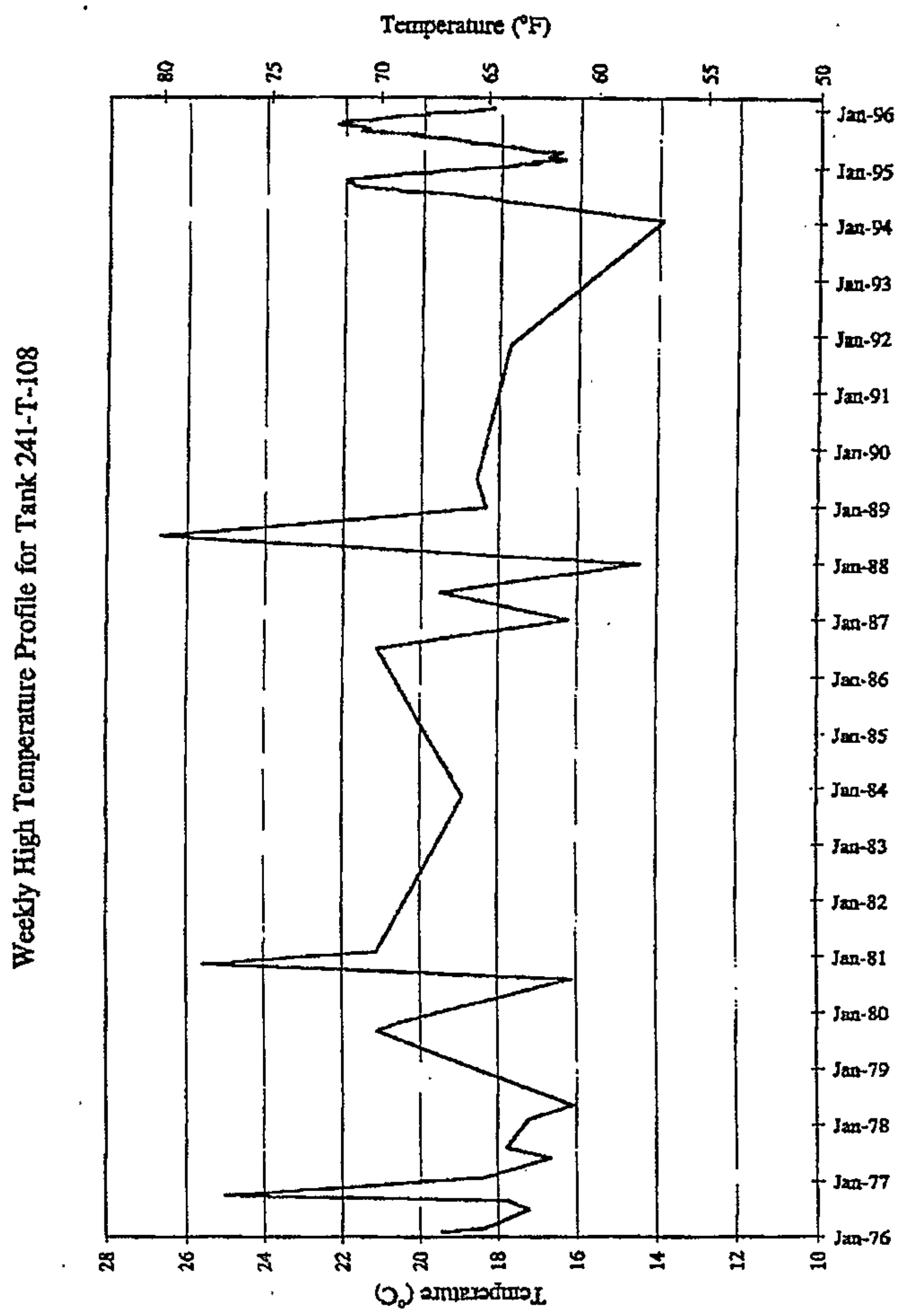


Figure 2-5. Tank 241-T-108 Weekly High Temperature Plot.

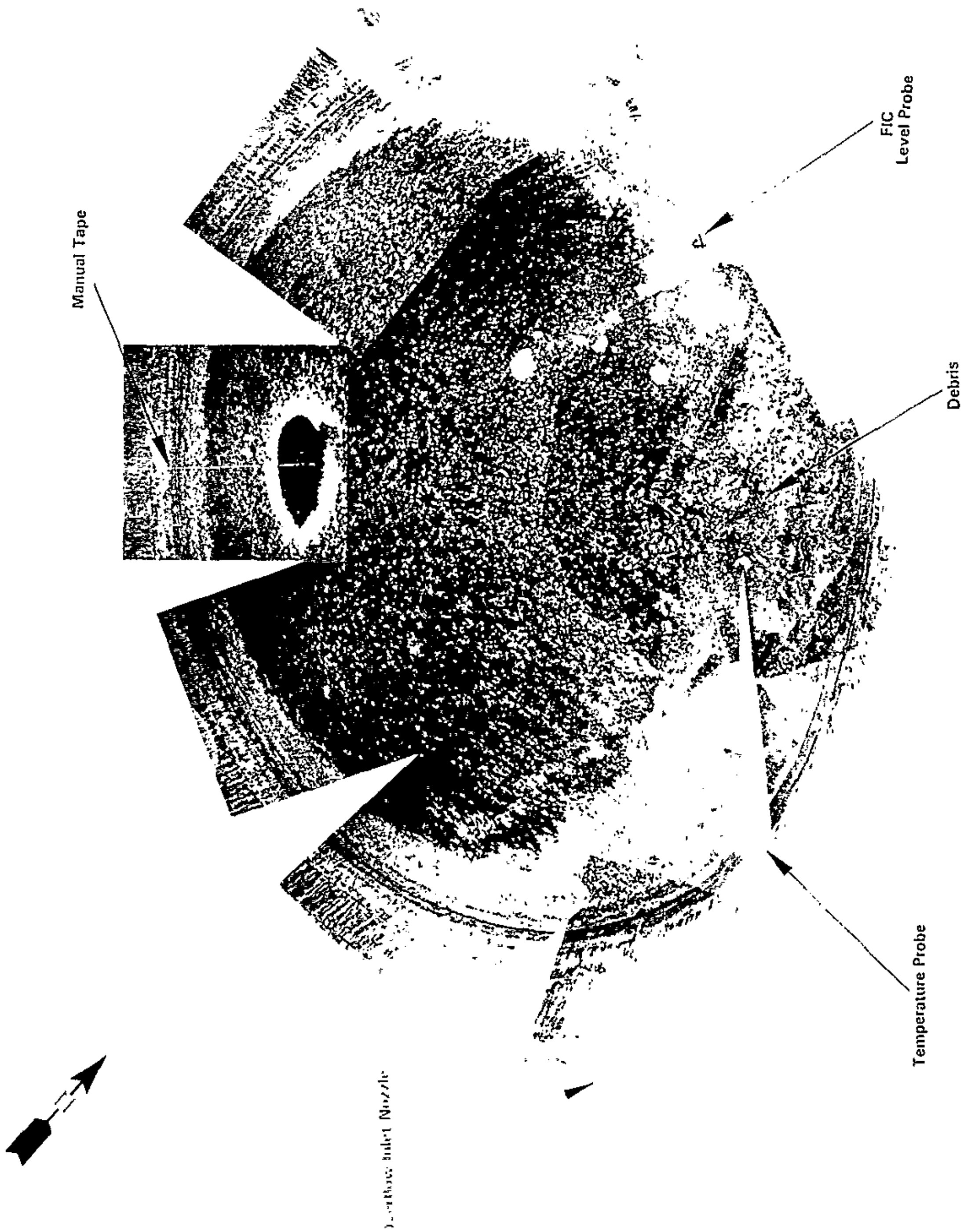


2.4.3 Tank 241-T-108 Photographs

The 1984 photographic montage of the tank 241-T-108 waste surface (see Figure 2-6) shows a variety of color. The exterior portion of the tank crust appears to be light brown, and the interior portion appears to be dark brown. The dark brown portion appears to have formed over supernate. Blue areas are almost certainly caused by the photographic process, lighting, or development of the photographic images. A reddish material, which appears to surround the thermocouple tree, is probably excess plastic compound (fabri-film) used to mobilize radioactive particles on hardware removed from the tank. Several unidentified white lumps of material are visible. Visible equipment includes a manual tape, a Food Instrument Corporation probe, a thermocouple tree, and an overflow inlet nozzle. The tank has been inactive since the photographs were taken; therefore, the picture should show the tank contents accurately.

241-T-108
Photo date: 7-17-84

Figure 2-6. Photographic Montage of Tank 241-T-108



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3.0 TANK SAMPLING OVERVIEW

This section describes the July 1995 sampling and analysis event for tank 241-T-108. Auger samples were taken to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Babad et al. 1995) and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). Sampling and analysis were performed in accordance with the *Tank 241-T-108 Auger Sampling and Analysis Plan* (Baldwin 1995c). For further discussions of the sampling and analysis procedures, see the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994).

3.1 DESCRIPTION OF SAMPLING EVENT

Tank 241-T-108 was auger sampled from risers 2, 5, and 6 on July 19, July 20, and July 21, 1995. Samples were designated 95-AUG-037, 95-AUG-035, and 95-AUG-036, respectively. The auger sampling method was chosen because of the shallow depth (33 cm [13 in.]) of the waste in the tank; 50.8 cm (20 in.) augers were used. Sample 95-AUG-036 recovered no sample, and is not discussed further in this report. Table 3-1 summarizes the sampling mode, applicable DQOs, and the sampling and analytical requirements for this sampling event (Baldwin 1995b). The concentration of flammable gas in the tank headspace was measured prior to auger sampling, as required by the safety screening DQO.

Table 3-1. Integrated Requirements for Tank 241-T-108.[1]

Sampling Event	Sampling Requirements	Applicable References and Analytical Requirements
Auger sampling	Auger samples from a minimum of two risers separated radially to the maximum extent possible; vertical profiling of the waste.	Safety Screening Data Quality Objective: Moisture content, total alpha activity, and energetics. Historical Model Evaluation Requirements: GEA, ICP, and specific gravity.

Note:
[1]Baldwin (1995b)

3.2 SAMPLE HANDLING

Samples 95-AUG-035 and 95-AUG-037 were extruded and subsampled on July 24 at the 222-S Laboratory. Most of the waste did not adhere to the augers but fell to the sample tray when extruded. Both samples appeared to be composed of various sized medium brown crystals. Table 3-2 describes the samples.

Table 3-2. Auger Sample and Subsample Description.[1]

Riser	Dose Rate Through Drill String (mR/hr)	Sample Total Weight (g)	Description
Sample 95-AUG-035			
5	< 0.5	43.2	No drainable liquids were observed. Sample was found on flutes[2] 14 through 19. Most of sample had fallen off the auger onto the tray. Material resembled crystals of various sizes, which were medium brown in color. Material was subsampled as summarized in the hot cell narrative, and noted as 'whole segment' in the data summary sheets.
Sample 95-AUG-037			
2	1	30.5	No drainable liquids were observed. Sample was sparsely scattered between flutes 5 and 19. The majority of the sample had fallen into the sample tray when the auger sleeve was removed. The sample resembled crystals of various sizes which were medium brown in color. Material was subsampled as 'whole segment.'

Note:

[1]Baldwin (1995b)

[2]Auger flutes are the spiral groves along the auger shaft which entrain the waste sample. Flute 1 is at the top of the auger; flute 20 is at the bottom.

3.3 SAMPLE ANALYSIS

Safety screening analyses included alpha proportional counting to measure the potential for a critical nuclear reaction based on total alpha activity, DSC to ascertain the fuel energy value, combustible gas meter readings to determine headspace gas flammability, and TGA to obtain the moisture content. Historical data evaluation analyses (listed as secondary analytes in Baldwin 1995c) were scheduled to be performed on the waste samples. Because of the uninteresting nature of the tank waste, the analyses were canceled by the Historical Program except for density and GEA. The Historical Program also required an ICP analysis on a water digest sample. Sampling and analytical requirements from the applicable DQOs were summarized in Table 3-1; other data for anions were obtained from the analyses as convenient (Kristofzski 1995).

Sections 3.3.1 through 3.3.6 provide a brief discussion of the sample analyses. Table 3-3 summarizes the analyses performed on samples. Quality control tests and their respective limits and requirements were performed and evaluated in accordance with the sampling and analysis plan (SAP) (Baldwin 1995c). Results of the quality control tests and the implications for data quality are discussed in Section 5.1.2.

Table 3-3. Summary of Samples and Analyses.[1]

Sample Number	Auger Portion	Labcore Number[2]	Analyses
95-AUG-035	Whole auger	1320	TGA, specific gravity, DSC
		1321	Total alpha, GEA
		1338	ICP H_2O/acid digest, IC
		1402	ICP acid digest
95-AUG-037	Whole auger	1323	TGA, specific gravity, DSC
		1324	Total alpha, GEA,
		1339	ICP H_2O/acid digest, IC
		1403	ICP acid digest

Notes:

[1]Baldwin (1995b)

[2]Labcore sample numbers were abbreviated for simplification. Labcore sample numbers for auger samples 95-AUG-035 and 95-AUG-037 all contain the prefix "S95T000." Duplicate samples have the same number as the original samples.

3.3.1 Thermal Analyses - TGA and DSC

TGA and DSC analyses were performed on homogenized samples under a nitrogen purge. Sample masses ranged from 6.00 to 51.387 mg. Quality control tests included duplicates and standards.

3.3.2 Total Alpha Analysis

Total alpha activity analyses were performed on fused samples using an alpha proportional counter. Two fusions were prepared for each sample to obtain duplicate results. Quality control tests included duplicates, blanks, standards, and spikes.

3.3.3 Specific Gravity

Specific gravity measurements were performed in accordance with the requirements of the historical DQO. Quality control tests included duplicate analyses and standards. Insufficient sample precluded the duplicate analysis of sample 95-AUG-037.

3.3.4 Gamma Energy Analysis

Gamma energy analyses were performed on samples which had been prepared by a potassium hydroxide fusion procedure. Quality control tests included standards, blanks, duplicate samples, and spike recoveries.

3.3.5 Inductively Coupled Plasma Spectroscopy

Inductively coupled plasma spectroscopy analyses were performed on the acid digested waste samples to satisfy the historical DQO requirements. The Historical Program also requested ICP analysis on water digested samples. Quality control tests included standards, blanks, duplicate samples, and spike recoveries.

3.3.6 Ion Chromatography

Ion chromatography analyses were performed on water digested samples. No complexants were measured. Quality control tests included standards, blanks, duplicate samples, and spike recoveries.

Table 3-4 summarizes the analytical procedure titles, instruments, and preparation methods used to analyze tank 241-T-108 samples.

Table 3-4. Analytical Procedures.[1]

Analysis	Instrument	Preparation Procedure	Procedure Number
Energetics by DSC	Mettler™ Perkin-Elmer™	Not applicable	LA-514-113, Rev. B-1 LA-514-114, Rev. B-0
Percent Water by TGA	Mettler™ Perkin-Elmer™	Not applicable	LA-560-112, Rev. A-2 LA-514-114, Rev. B-0
Total Alpha Activity	Alpha proportional counter	LA-549-141, Rev. D-0	LA-508-101, Rev. D-2
Specific Gravity	Not applicable	Not applicable	LA-510-116, Rev. A-0
^{137}Cs, ^{241}Am, ^{60}Co, ^{154}Eu, ^{155}Eu	Gamma energy analysis	LA-549-141, Rev. D-0	LA-548-121, Rev. D-1
Metals	Inductively coupled plasma/atomic emission spectrometer	LA-505-159, Rev. B-2 LA-504-101, Rev. D-0	LA-505-151, Rev. A-1 LA-505-151, Rev. D-3
Anions	Ion chromatograph	LA-504-101, Rev. D-0	LA-533-105, Rev.C-2
Flammable gas[2]	Combustible gas meter	Not applicable	TO-080-500, Rev. B-2

Notes:

Mettler™ is a registered trademark of Mettler Electronics, Anaheim, California.

Perkin-Elmer™ is a registered trademark of Perkins Research and Manufacturing Company, Inc., Canoga Park, California.

[1]Baldwin (1995a and 1995b)

[2]WHC (1995)

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4.0 ANALYTICAL RESULTS

4.1 OVERVIEW

This section provides the analytical results associated with the auger sampling of tank 241-T-108. The sampling and analysis were performed in accordance with the SAP (Baldwin 1995c) which includes requirements for the safety screening and historical programs. The section includes a summary of the requested analytes and analytical results and a discussion of each analysis.

Table 4-1 lists the locations of the tabulated data. Although the SAP required that analyses be performed on the half-auger level, they were performed at the whole auger level because of the small size of the samples. Historical data evaluation analyses (listed as secondary analytes in Baldwin 1995c) were scheduled to be performed on the waste samples. Because of the uninteresting nature of the tank waste, however, the analyses were canceled by the Historical Program (Baldwin 1995b) except for density, ICP and GEA. In addition to the analyses required by the SAP, analyses were performed on an opportunistic basis for selected analytes in accordance with Kristofzski (1995).

Table 4-1. Analytical Data Tables.

Table Title	Table Number
Auger Sample Data Summary	Table 4-2
Thermogravimetric Analysis Results	Table 4-3
Differential Scanning Calorimetry	Table 4-4
1995 Analytical Data	Appendix A

4.2 CHEMICAL DATA SUMMARY

An overall mean was calculated for each analyte by averaging concentration values for the auger samples obtained from two different risers. The results for the sample and duplicate were averaged yielding an auger mean. The two auger means were averaged to obtain an overall tank mean. This was done to assure that each auger was weighted equally. Individual sample results and their respective duplicate results are reported in Appendix A. Only a mean value and a relative standard deviation (RSD) of the mean reported in percent (defined as the standard deviation divided by the mean multiplied by 100) are reported in this section. The RSDs (mean) were calculated using standard analysis of variance (ANOVA) statistical techniques.

In addition to the overall mean, a projected tank inventory was calculated for all analytes except for energetics and percent water. The projected inventory is the product of the concentration of the analyte, the amount of waste in the tank (170 kL), and the specific gravity of 2.35. Table 4-2 summarizes the mean concentrations, relative standard deviations of the mean concentrations, and the projected inventories. Only the inventory projections from the ICP results using the acid digestions are provided in Table 4-2; the water leach results are in Appendix A.

Table 4-2. Auger Sample Data Summary.[1] (2 sheets)

Analyte	Mean	RSD (Mean)	Projected Inventory[2]
Metals	(μg/g)	(%)	(kg)
Al	2,290	88.0	915
Sb	< 159	n/a	< 63.5
As	< 39.8	n/a	< 15.9
Ba	< 39.8	n/a	< 15.9
Be	< 3.98	n/a	< 1.59
Bi	605	84.0	242
B	193	80.9	77.1
Cd	< 7.96	n/a	< 3.18
Ca	177	50.7	70.7
Ce	< 79.6	n/a	< 31.8
Cr	19.2	69.1	7.67
Co	< 15.9	n/a	< 6.35
Cu	< 7.96	n/a	< 3.18
Fe	6,110	89.3	2,440
La	< 39.8	n/a	< 15.9
Pb	533	81.9	213
Li	< 7.96	n/a	< 3.18
Mg	< 79.6	n/a	< 31.8
Mn	182	51.0	72.7
Mo	< 39.8	n/a	< 15.9
Nd	< 79.6	n/a	< 31.8
Ni	< 15.9	n/a	< 6.35
P	37,400	88.7	14,900
K	< 239	n/a	< 95.5

Table 4-2. Auger Sample Data Summary.[1] (2 sheets)

Analyte	Mean	RSD (Mean)	Projected Inventory[2]
Metals	(μg/g)	(%)	kg
Sm	< 79.6	n/a	< 31.8
Se	< 79.6	n/a	< 31.8
Si	1,500	93.0	599
Ag	< 7.96	n/a	< 3.18
Na	2.23E+05	10.2	89,100
Sr	21.6	72.4	8.63
S	371	80.0	148
Ti	< 7.96	n/a	< 3.18
Tl	< 159	n/a	< 63.5
U	1,130	79.3	451
V	< 39.8	n/a	< 15.9
Zn	52.6	52.2	21.0
Zr	10.9	45.4	4.35
Anions	(μg/g)	(%)	(kg)
Br^-	< 6,900	n/a	< 2,760
Cl^-	< 905	n/a	< 362
F^-	10,700	88.7	4,270
NO_3^-	3.92E+05	73.9	1.57E+05
NO_2^-	6,210	73.8	2,480
PO_4^{3-}	1.25E+05	79.6	49,900
SO_4^{2-}	7,430	80.0	2,970
Radionuclides	(μCi/g)	(%)	(Ci)
Total alpha	0.0702	35.2	28.0
^{241}Am	< 0.123	n/a	< 49.1
^{60}Co	< 0.0133	n/a	< 5.31
^{137}Cs	2.00	69.0	799
^{154}Eu	< 0.0455	n/a	< 18.2
^{155}Eu	< 0.0407	n/a	< 16.3

Notes:

[1]Baldwin (1995b)

[2]Projected inventories for the metals were based on the acid digestion results.

4.3 PHYSICAL DATA SUMMARY

This section discusses the physical analyses performed on the auger samples. As requested by the Historical Program, specific gravity measurements were made on the samples. Thermal analyses (TGA and DSC) were performed to satisfy the safety screening DQO.

4.3.1 Specific Gravity

Specific gravity measurements were performed using procedure LA-510-116, Rev. A-0 (Baldwin 1995b). The volume of a sludge sample with a known mass was measured by a displacement method using a nonpolar liquid. Then the specific gravity was computed by dividing the mass of the sludge sample by the mass of an equal volume of water. The specific gravity results ranged from 2.64 to 1.95 with an overall average of 2.35. The individual sample and duplicate results are in Appendix, Table A-90. There was insufficient sample for a duplicate analysis on auger sample 95-AUG-037.

4.3.2 Thermal Analyses

Thermal analyses were performed on the auger samples in accordance with the safety screening DQO. The results of the TGA and DSC analyses were used jointly to determine the ability of the waste to propagate an exothermic reaction.

4.3.2.1 Thermogravimetric Analysis. In TGA, the mass of a sample is measured while its temperature is increased at a constant rate. A gas, such as nitrogen or air, is passed over the sample while it is being heated to remove any gaseous matter. Any decrease in the weight of a sample represents a loss of gaseous matter from the sample either through evaporation or through a reaction that forms gas phase products. Water content, thermal decomposition temperatures, and reaction temperatures can be obtained from the TGA scans. The TGA for the tank 241-T-108 auger samples was performed under a nitrogen purge using procedure LA-560-112, Rev. A-2 or LA-514-114, Rev. B-0.

As shown in Table 4-3, there is a large disparity among the TGA results. Sample 1320 of auger 95-AUG-035 was reanalyzed because of the large relative percent difference (RPD) between original and duplicate results. The reanalysis results were also outside RPD limits. All results were well below the safety screening limits with a mean of 1.69 weight percent water. Notifications were not required, however, because no exothermic reactions were observed during the DSC analyses. Both the sample and duplicate for 95-AUG-037 were well above the safety screening limit, with a mean of 37.3 and a 90 percent confidence lower limit of 33.1.

Table 4-3. Thermogravimetric Analysis Results for Tank 241-T-108[1].

Sample Number	Auger Number	Temp. Range (°C)	Result % H_2O	Duplicate % H_2O	Mean % H_2O	Overall Mean % H_2O		RSD (Mean) %
1320[2]	95-AUG-035	35-105	4.32	0.770	2.55	1.69	19.5	105
1320[3]	95-AUG-035	20-85	0.544	1.12	0.832			
1323	95-AUG-037	35-130	35.93	38.68	37.3	37.3		

Note:

Temp. = temperature

[1]Baldwin (1995a)
[2]TGA performed using a Mettler™ instrument.
[3]TGA performed using a Perkin-Elmer™ instrument.

4.3.2.2 Differential Scanning Calorimetry. In DSC, heat absorbed or emitted by a substance is measured while the substance is exposed to a linear increase in temperature. While the substance is being heated, a gas such as nitrogen is passed over the waste material to remove gases that may be released. The onset temperature for an endothermic (characterized by or causing the absorption of heat) or exothermic (characterized by or causing the release of heat) event is determined graphically. Data generated by DSC analyses also describe heats of reaction, melting points, and solid-solid transition temperatures.

DSC analyses were performed under a nitrogen atmosphere using procedure LA-514-113, Rev. B-1, and a Mettler Model 20 differential scanning calorimeter, and procedure LA-514-114, Rev. B-0, and Perkin-Elmer equipment. No exothermic reactions were observed. No problems with quality control were noted.

The DSC results are shown in Table 4-4. The sample weight, temperature at maximum enthalpy change, and the magnitude of the enthalpy change are provided for each transition. The first transition represents the endothermic reaction associated with the evaporation of free and interstitial water. The second and third transitions probably represent the energy (heat) required to remove bound water from hydrated compounds such as aluminum hydroxide or to melt salts such as sodium nitrate.

Table 4-4. Differential Scanning Calorimetry Results for Tank 241-T-108.[1]

Sample Number	Auger Number	Run	Sample Weight (mg)	Transition 1		Transition 2		Transition 3	
				Peak (°C)	ΔH (J/g)	Peak (°C)	ΔH (J/g)	Peak (°C)	ΔH (J/g)
1320	95-AUG-035	1	35.278	68.8	94.1	376.3	35.2	305.3	109.5
		2	22.354	47.1	60.0	279.0	23.3	311.3	149.0
1323	95-AUG-037	1	8.260	114.78	1,103.1	254.13	5.815	308.12	37.31
		2	6.000	99.847	954.9	---	---	---	---

Note:

ΔH = change in enthalpy

[1]Baldwin (1995a)

4.4 TANK HEADSPACE FLAMMABILITY

To address flammable vapor issues, the safety screening DQO requires sampling of the tank headspace. Prior to removal of the auger samples, vapor samples were obtained from the tank headspace and analyzed using a combustible gas meter. Readings were 0 percent of the lower flammability limit (WHC 1995) indicating no flammability concerns.

5.0 INTERPRETATION OF CHARACTERIZATION RESULTS

The purpose of this chapter is to evaluate the overall quality and consistency of the available results for tank 241-T-108 and to assess and compare these results with historical information and program requirements.

5.1 ASSESSMENT OF SAMPLING AND ANALYTICAL RESULTS

This section evaluates sampling and analysis factors that may impact the use or interpretation of data. These factors are used to assess the overall quality and consistency of the data and to identify limitations in its use. Because of the lack of analyses, some consistency checks were not possible.

5.1.1 Field Observations

Sample recovery was zero for sample 95-AUG-036 and poor for augers 95-AUG-035 and 95-AUG-037 (Baldwin 1995a). Although almost 10 in. of sample was expected from 95-AUG-035, material was found only on flutes 14 to 19 (3 in.). The amount of sample recovered was less than expected from six full auger flutes as well. Fifteen inches of sample was expected from 95-AUG-037, and material was found on flutes 5 to 19 (7.5 in.). The mass of sample was much less than expected from 15 full flutes. Therefore, the representativeness of the samples with regard to the entire tank contents may be questionable.

5.1.2 Quality Control Assessment

The usual quality control assessment includes an evaluation of the appropriate blanks, duplicates, spikes, and standards performed in conjunction with chemical analyses. All of the pertinent quality control tests were conducted on the 1995 sample results and reported in Baldwin (1995b). The SAP (Baldwin 1995c) established the specific accuracy and precision criteria for three of the quality control checks. The fourth, blank contamination, has a criterion set by the laboratory of no detected blank value being larger than five percent of the analyte concentration (DOE 1995). Sample and duplicate pairs, which had one or more quality control results outside the SAP and laboratory target levels, were footnoted in Appendix A data tables.

Several standards were outside the limits set by the SAP. For ICP analytes, this was most likely caused by the high dilutions required by the large amount of sodium that was present. The high standard recovery for sodium was the result of expected contamination caused by sodium's natural abundance in the environment. The high standard recovery for silicon was caused by hydrofluoric acid, present in the standard, leaching silicate from the boron silicate glassware used for the standard preparation. Hydrofluoric acid is not used in sample preparation.

Both spike recoveries conducted for total alpha activity were outside the target level, and reruns produced the same results (Baldwin 1995a). However, the analytical results were far below the safety screening action limit, and deviations were not substantial enough to affect the criticality evaluation. As noted, the high levels of sodium required high dilutions for the ICP samples. In turn, the high dilutions caused poor or meaningless spike recoveries for ICP elements that had very high concentrations or were close to the detection limit. The RPDs were similarly affected for these elements.

The laboratory analytical precision is estimated by the RPD, which is defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times one hundred. A number of duplicate pairs had RPDs larger than the SAP limits, but most or all were caused by sample heterogeneity or large sample dilutions (ICP only). The crystalline sample material did not easily lend itself to complete homogenization. Finally, no sample violated the criterion for preparation blanks; therefore, contamination was not a problem for any analysis.

In summary, the vast majority of the quality control results were within the boundaries specified in the SAP (Baldwin 1995c). As noted in Appendix A tables, some samples did have quality control results outside SAP boundaries. However, an evaluation of quality control discrepancies has been made, and these discrepancies have not been found to impact data validity or use.

5.1.3 Data Consistency Checks

Comparing different analytical methods can be beneficial in assessing data consistency and quality. Several comparisons were possible with the data set provided by the two auger samples including the comparison of phosphorus and sulfur as analyzed by ICP with phosphate and sulfate as analyzed by IC and the calculation of a mass and charge balance. Other consistency checks, such as total alpha or total beta compared to the sum of the individual alpha or beta emitters, were not possible because of the lack of data.

5.1.3.1 Comparison of Results from Different Analytical Methods. The following data consistency checks compare the results from two or more analytical methods for a given analyte. A close correlation between the two methods strengthens the credibility of both results; a poor correlation brings the reliability of the data into question.

The analytical phosphorus mean result determined by ICP (water wash) was 18,700 μg/g, which is equivalent to 57,500 μg/g of phosphate. This compares poorly with the IC phosphate results of 1.25E+05 μg/g, with an RPD of 73.9. The mean ICP sulfur result (water wash) was 145 μg/g, which is equivalent to 434 μg/g of sulfate. The RPD between this result and the result of the IC sulfate analysis of 7,430 μg/g is 178. Both the phosphate-phosphorus comparison and the sulfate-sulfur comparison should be closer because both tests measure water-soluble species.

5.1.3.2 Mass and Charge Balance. The principle objective in performing a mass and charge balance is to determine whether measurements were consistent. When calculating the balances, only the analytes listed in Table 4-2, which were detected at a concentration of 2,000 μg/g or greater, were considered.

Except for sodium, all cations listed in Table 5-1 were assumed to be in their most common hydroxide or oxide form, and the concentrations of the assumed species were calculated stoichiometrically. Because precipitates are neutral species, all positive charge was attributed to the sodium cation. The anionic analytes listed in Table 5-2 were assumed to be present as sodium salts and were expected to balance the positive charge exhibited by the cations. Sulfur is considered to be present as the sulfate ion and phosphorus as the phosphate ion. Both species are assumed to be completely water soluble and appear only in the anion mass and charge calculations. The concentrations of the cationic species listed in Table 5-1, the anionic species listed in Table 5-2, and the percent water were used to calculate the mass balance. The uncertainty estimates (RSDs) associated with each analyte are also listed in the tables. The uncertainty for the cation and anion totals, as well as the overall uncertainty estimate given in Table 5-3, were computed by a statistical procedure known as the propagation of errors (Bennett and Bowen 1988).

The mass balance was calculated from the formula below. The factor 0.0001 is the conversion factor from μg/g to weight percent.

Mass balance = % Water + 0.0001 x {total analyte concentration}
= % Water + 0.0001 x {$Al(OH)_3$ + $FeO(OH)$ + Na^+ + F^- + NO_3^- + NO_2^- + PO_4^{3-} + SO_4^{2-}}

The total analyte concentration calculated from the above equation was 7.80E+05 μg/g. The mean weight percent water obtained from thermogravimetric analysis shown in Table 4-2 is 19.5 percent. The mass balance resulting from adding the percent water to the total analyte concentration is 97.5 percent (see Table 5-3).

The following equations demonstrate the derivation of total cations and total anions, and the charge balance is the ratio of these two values.

Total cations (microequivalents) = Na^+/23.0 = 9,700 microequivalents

Total anions (microequivalents) = F^-/19.0 + NO_3^-/62.0 + NO_2^-/46.0 + PO_4^{3-}/31.7 + SO_4^{2-}/48.1 = 11,100 microequivalents

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 0.874.

In summary, the above calculations yield reasonable (close to 1.00 for charge balance and 100 percent for mass balance) mass and charge balance.

Table 5-1. Cation Mass and Charge Data.

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	RSD (Mean) (%)	Charge (μeq/g)
Al	2,290	$Al(OH)_3$	6,620	88.0	0
Fe	6,110	FeO(OH)	9,720	89.3	0
Na	2.23E+05	Na^+	2.23E+05	10.2	9,700
Totals			2.39E+05	10.5	9,700

Table 5-2. Anion Mass and Charge Data.

Analyte	Concentration (μg/g)	RSD (Mean) (%)	Charge (μeq/g)
F^-	10,700	88.7	563
NO_3^-	3.92E+05	73.9	6,320
NO_2^-	6,210	73.8	135
PO_4^{3-}	1.25E+05	79.6	3,940
SO_4^{2-}	7,430	80.0	155
Totals	5.41E+05	57.3	11,100

Table 5-3. Mass Balance Totals.

	Concentrations (μg/g)	RSD (Mean) (%)
Total from Table 5-3	2.39E+05	10.5
Total from Table 5-4	5.41E+05	57.3
Water %	1.95E+05	105
Grand Total	9.75E+05	38.1

5.2 COMPARISON OF HISTORICAL AND ANALYTICAL RESULTS

Because of a lack of historical sampling data, no comparisons between current and historical analytical results were possible.

5.3 TANK WASTE PROFILE

One of the objectives of the 1995 sampling event was to provide a 10-in. vertical profile of the waste from two widely-spaced risers (Baldwin 1995c). The second condition was met, but a vertical profile was not obtained because both auger samples were homogenized and analyzed on a whole segment basis. Therefore, information on the possible vertical disposition of the waste was available only from the TLM (Agnew et al. 1995a). According to the TLM, the waste is composed of two layers. The bottom 21 kgal is predicted to be 1C1 waste; the upper layer, T1SLTCK. The compositions of the two waste types differ (see Section 2.3.2); therefore, the tank contents were expected to be vertically heterogeneous. From the extrusion observations, however, the sampled waste appeared similar. Furthermore, these observations suggest that only saltcake was sampled. Because of the close proximity of the sampling risers to the tank walls, it is probable that the waste in the tank's dished bottom was not sampled. If 21 kgal of 1C1 waste is present as predicted, it would equate to 15 in. of waste, 12 of which would comprise the dished bottom. Surveillance data provide a surface level measurement of 13.1 in. as measured from the base of the sidewall (does not include the dish). Because only 10 in. of the waste was sampled by the augers, the 3 in. above the dish were not sampled. Therefore, it is possible that the none of the 1C1 waste was sampled.

Although multiple segments were not available for a vertical analysis of the tank waste, the fact that two risers were sampled allowed a statistical procedure known as the one-way analysis of variance (ANOVA) to be conducted to determine whether there were any horizontal differences in analyte concentrations. Analyses were calculated only for analytes where half or more of the individual measurements were above the detection limit, except for ICP water-digested results. For the ICP analytes, only acid-digested results were used. The ANOVA generates a p-value which is compared with a standard significance level (α = 0.05). If a p-value is below 0.05, there is sufficient evidence to conclude that the sample means are significantly different from each other. However, if a p-value is above 0.05, there is not sufficient evidence to conclude that the samples are significantly different from each other.

The results of the ANOVA tests indicated that 22 of 25 analytes had significant concentration differences between the two risers. Except for sulfur (p-value = 0.083), all other 16 metals were significantly different. All five anions tested were significantly different as well as percent water and ^{137}Cs, but total alpha activity (p-value = 0.145) and density (p-value = 0.889) were not significantly different. Of the 22 analytes which had significant differences between risers, only sodium, nitrate, nitrite, and sulfate had larger concentrations at riser 5 (95-AUG-035) than at riser 2 (95-AUG-037). This does not appear to be caused by the location of the overflow inlet into the tank, because this inlet is almost equidistant between the two risers. The large discrepancy between the two auger samples could be caused by sample preparation. Sample homogenization can be very difficult with crystalline solids. In addition, the large difference in water content between the augers could affect the analytical results.

In summary, the available evidence suggests horizontal heterogeneity of the waste. Vertically, the TLM predicts two layers of waste are present, but this prediction was not verified visually and could not be verified statistically.

5.4 COMPARISON OF ANALYTICAL AND TRANSFER DATA

The concentrations of various waste constituents in tank 241-T-108 are shown in Table 5-4 along with the 1995 analytical results (from Table 4-2). Comparing the HTCE with the analytical values produced moderate to poor data correlation. A total of 18 analytes were compared. Three analytes (nitrite, fluoride, and phosphate) had RPDs under 29 percent. Four analytes (silicon, iron, density, and sodium) exhibited RPDs from 39 to 57 percent. The RPDs for the remaining 11 analytes ranged from 104 to 194 percent.

Table 5-4. Comparison of Historical Tank Content Estimate Data with 1995 Analytical Results for Tank 241-T-108. (2 sheets)

Analyte	1995 Analytical Result	HTCE Data	Relative Percent Difference
METALS	µg/g	µg/g	%
Al	2,290	12,600	138
Bi	605	6,800	167
Ca	177	2,840	176
Cr	19.2	339	179
Fe	6,110	9,540	44
Si	1,500	2,230	39
Na	2.23E+05	1.24E+05	57
U	1,130	228	132
Zr	10.9	717	194
IONS	µg/g	µg/g	%
F^-	10,700	8,210	26
NO_3^-	3.92E+05	75,100	136
NO_2^-	6,210	4,820	25
PO_4^{3-}	1.25E+05	94,000	28.3
SO_4^{2-}	7,430	23,500	104

Table 5-4. Comparison of Historical Tank Content Estimate Data with 1995 Analytical Results for Tank 241-T-108. (2 sheets)

Analyte	1995 Analytical Result	HTCE Data	Relative Percent Difference
RADIONUCLIDES	μCi/g	μCi/g	%
^{137}Cs	2.00	9.25	129
^{138}Pu and $^{239/240}$Pu	0.0702 (total α)	0.00588	169
PHYSICAL PROPERTIES			%
Percent Water	19.5 wt%	62.2 wt%	105
Specific Gravity	2.35	1.46	47

5.5 EVALUATION OF PROGRAM REQUIREMENTS

The two 1995 tank 241-T-108 auger samples analyzed at the 222-S Laboratory were acquired to meet the requirements of the safety screening DQO (Babad et al. 1995) and the historical DQO (Simpson and McCain 1995). A discussion of the requirements of each document and a comparison of the analytical data to defined concentration limits is provided below.

5.5.1 Safety Evaluation

Data criteria, identified in the safety screening DQO (Babad et al. 1995), are used to assess the safety of the waste and to check for unidentified safety issues. As discussed in Section 5.3, the DQO requires a vertical profile from two widely-spaced risers. A vertical profile was not obtained because of poor sample recovery. The auger samples were subsampled as whole segments (or augers) instead of as half segments as prescribed by the DQO. Four primary analyses are required by the safety screening DQO: DSC to evaluate energetics, combustible gas meter readings to determine headspace gas flammability, TGA to measure weight percent water, and total alpha activity to evaluate potential criticality concerns. For each analysis, a notification limit was established by the DQO which, if exceeded, might warrant further investigation to assure tank safety. A final requirement of the safety screening DQO is to determine the flammability of the tank headspace vapors.

The safety screening DQO has established a notification limit of 481 J/g (dry weight basis) for the DSC analysis. No exothermic reactions were observed in the samples from 95-AUG-035 and 95-AUG-037. Limited sample was available; therefore, analyses were performed on a whole segment basis rather than on a half-segment basis as required by the DQO.

The safety screening DQO notification limit of less than 17 weight percent water was exceeded for all four TGA results of auger 95-AUG-035. The lower 90 percent confidence level calculated for these samples was zero. For auger 95-AUG-037, the mean weight percent water was 37.3 percent, well above the notification limit, with a lower 90 percent confidence level of 33.1. The overall mean for the tank was calculated to be 19.5 percent. Because no DSC result exceeded the limit, the low percent water values do not exceed the current safety screening DQO standards. The Safety Program determined secondary gravimetric analyses to confirm the percent water results were not required (Baldwin 1995b).

The criticality issue is assessed from the total alpha activity. No sample from the 1995 data contained total alpha activity greater than 0.115 μCi/g. This was well below the notification limit of 26.2 μCi/g (see footnote 1 of Table 5-5 for derivation) (Baldwin 1995c). The results of the 90 percent upper confidence limit for 95-AUG-035 and 95-AUG-037 were 0.07 μCi/g and 0.16 μCi/g, respectively, also well below the notification limit.

The safety screening DQO has established the notification limit for headspace vapors to be 25 percent of the lower flammability limit. Combustible gas meter readings, taken at the time of sampling, revealed that the concentration of flammable gases was 0 percent of the lower flammability limit (WHC 1995).

Table 5-5. Comparison of 1995 Analytical Data with Safety Screening Data Quality Objective Criteria.[1]

Safety Issue	Primary Decision Threshold	Decision Criteria Threshold	Analytical Results
Ferrocyanide /Organics	Total fuel content	> 481 J/g	No exothermic reactions observed
Organics	Percent moisture	< 17 weight %	Overall tank mean = 19.5%. Lowest value = 0.544%
Criticality	Total alpha	> 1 g/L[1] = 26.2 μCi/g	Mean = 0.0702 μCi/g Highest value = 0.115 μCi/g
Flammable gas	Flammable gas	> 25% of the lower flammability limit	0 percent of the lower flammability limit

Note:

[1]Although the actual decision criterion listed in the DQO is 1 g/L, total alpha is measured in μCi/g rather than g/L. To convert the notification limit for total alpha into units of μCi/g, it was assumed that all alpha decay originates from ^{239}Pu. The estimated notification limit of 26.2 μCi/g was determined by using a density of 2.35 g/mL and the specific activity of ^{239}Pu (0.0615 Ci/g). The following equation shows the conversion to μCi/g from g/L:

$$\left(\frac{1\ \text{g}}{\text{L}}\right)\left(\frac{1\ \text{L}}{10^3\ \text{mL}}\right)\left(\frac{1}{\text{density}}\frac{\text{mL}}{\text{g}}\right)\left(\frac{0.0615\ \text{Ci}}{1\ \text{g}}\right)\left(\frac{10^6\ \mu\text{Ci}}{1\ \mu\text{Ci}}\right) = \frac{61.5}{\text{density}}\frac{\mu\text{Ci}}{\text{g}}$$

5.5.2 Historical Evaluation

In addition to the safety screening DQO, samples were analyzed in accordance with the historical DQO (Simpson and McCain 1995). This DQO strives to quantify the errors associated with the tank waste composition predictions (based on waste transaction history and waste type compositions). The DQO identifies key components or "fingerprint" analytes for certain waste types including T1SLTCK waste. Tank 241-T-108 has been selected as a tank for historical evaluation because it is expected to contain a layer of T1SLTCK waste (according to the TLM [Agnew et al. 1995a]). The first step in the evaluation is a comparison of the analytical results with the DQO-defined concentration levels for the "fingerprint" analytes. If the analytical results are ≥10 percent of the DQO levels (ratio of 0.1), the waste type and layering identification are considered acceptable for further investigation (Simpson and McCain 1995).

Table 5-6 compares the concentration levels for T1SLTCK waste from the historical DQO and the analytical results. All analytes had analytical results at least 10 percent of the DQO specified level; consequently, it appeared that the T1SLTCK layer was appropriately identified. Analyses quantifying the uncertainties associated with T1SLTCK are pending. However, after consultation with the Historical Program, it was decided to end the historical evaluation at this step because of the uninteresting nature of the waste.

Table 5-6. Comparison of Fingerprint Analytes with Analytical Results.

T1 Saltcake Fingerprint Analytes	Analytical Results ($\mu g/g$)	Historical DQO T1SLTCK Concentration Levels[1]	Ratio
Sodium	2.23E+05	1.44E+05+	1.55
Nitrate	3.92E+05	86,000	4.56
Phosphate	1.25E+05	96,900	1.29
Fluoride	10,700	11,000	0.97
Percent water	19.5	36.1	0.54

Note:
[1]Historical DQO concentration levels taken from Simpson and McCain (1995).

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6.0 CONCLUSIONS AND RECOMMENDATIONS

The waste in tank 241-T-108 has been sampled and analyzed for the purposes of safety screening in accordance with the requirements listed in the *Tank Safety Screening Data Quality Objective* (Babad et al. 1995) and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). The tank was sampled in July 1995 using the auger sampling method. Low sample recoveries were obtained, limiting analyses to a whole segment basis. The safety screening DQO required analyses for percent water, energetics, total alpha activity, and flammable gas. The historical model DQO required analyses including ICP and IC for comparison to the data in the TLM and the HTCE. Secondary analyses, except for density and gamma energy emitting isotopes, were canceled by the Historical Program (Baldwin 1995b).

All analyses, except for the percent water of auger sample 95-AUG-035, met the requirements of the safety screening DQO. Because exothermic behavior was not observed in the waste samples, the low percent water values do not constitute a safety concern for the tank. The tank headspace vapor concentrations were 0 percent of the lower flammability limit.

No heat load calculation was possible from the analytical data because there was no determination of ^{90}Sr; however, an estimated value of 0.0124 kW is listed in the HTCE, which is well below the 11.7 kW limit separating high-heat and low-heat load tanks (Bergmann 1991). The average tank temperature between 1976 and 1996 was 19 °C (67 °F), with a minimum of 14 °C (57 °F) and a maximum of 27 °C (81 °F).

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APPENDIX A

ANALYTICAL RESULTS FROM 1995 AUGER SAMPLING

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A.1 INTRODUCTION

Appendix A provides the chemical, radiochemical, and physical characteristics of tank 241-T-108 in terms of specific concentrations of metals, ions, radionuclides, and physical properties.

Table A-1 lists the analytes tested for, the percent water, and the specific gravity of solids/sludges. The subsequent tables (A-2 through A-90) lists the following: laboratory sample identification, sample origin (auger/auger portion), an original and duplicate result for each sample, a sample mean, a mean for the tank in which both augers are weighted equally, a relative standard deviation of the mean, and a projected tank inventory for the particular analyte using the weighted mean and the appropriate conversion factors. The projected tank inventory column is not applicable for the percent water or density data. The data are listed in standard notation for values greater than 0.001 and less than 100,000. Values outside these limits are listed in scientific notation.

For each analytes, there are two data tables, one reporting water-digest results and the other acid-digest results. A description of the units and symbols used in the analyte tables and the references used in compiling the analytical data are in the List of Terms and Section 7.0.

A.2 ANALYTE TABLE DESCRIPTION

Column 1 (Sample Number) lists the laboratory sample for which the analyte was measured. For information on sampling rationale, locations, and descriptions of sampling events, see Section 3.0.

Column 2 (Auger) describes the auger from which the sample was derived.

Column 3 (Auger Portion) contains the auger portion from which the sample was taken. The entire segment is referred to as "whole". All analyses were performed on the whole-auger basis.

Columns 4 and 5 (Result and Duplicate) are self-explanatory. Column 6 (Mean) is the average of the result and duplicate values. All values, including those below the detection level (indicated by the less-than symbol, <), were averaged. If result and duplicate values were nondetected, the mean is expressed as a nondetected value.

Result and duplicate values were originally reported to higher significant figures than shown in the tables. The means were calculated by the laboratory, in a consistent manner, using these original data. The means may appear to have been rounded up in some cases and rounded down in others. However, this is because the analytical results are shown in the tables to fewer significant figures than originally reported, not because the means were incorrectly calculated.

The overall mean in column seven was calculated by averaging the two auger means.

In column 8, the RSD of the mean (in percent) is 100 times the standard deviation of the mean divided by the tank mean. Relative standard deviations of the mean were not computed for analytes that had more than 50 percent nondetected values. The standard deviation of the mean was estimated using standard ANOVA techniques. The standard deviation was calculated using all available data for a given analyte.

Column 9 (Projected Inventory) is the product of the tank (or analyte concentration) mean, the volume of tank waste (170 kL), the specific gravity of the waste (2.35), and the appropriate conversion factors.

The four quality control parameters assessed on tank 241-T-108 samples were standards, spikes, duplicates, and blanks. The quality control results were summarized in Section 5.1.2. More specific information is provided in each of the appendix tables. Sample and duplicate pairs, in which any of the quality control parameters were outside their specified limits, are footnoted in column 6 with an a, b, c, d, e, or f as follows:

"a" indicates that the standard recovery was below the quality control limit.

"b" indicates that the standard recovery was above the quality control limit.

"c" indicates that the spike recovery was below the quality control limit.

"d" indicates that the spike recovery was above the quality control limit.

"e" indicates that the RPD was outside the quality control limits.

"f" indicates that there was some blank contamination.

The quality control criteria specified in the SAP (Baldwin 1995c) for all liquid and solid analyses were 90 to 110 percent recovery for standards and matrix spikes and $\leq$ 10 percent for RPDs. The blank contamination has a criterion set by the laboratory of no detected blank value being larger than five percent of the analyte concentration (DOE 1995).

Table A-1. Analyte Data Tables. (3 sheets)

Analyte	Table	Location
Aluminum (Water Digest)	A-2	A-8
Aluminum (Acid Digest)	A-3	A-8
Antimony (Water Digest)	A-4	A-8
Antimony (Acid Digest)	A-5	A-9
Arsenic (Water Digest)	A-6	A-9
Arsenic (Acid Digest)	A-7	A-9
Barium (Water Digest)	A-8	A-10
Barium (Acid Digest)	A-9	A-10
Beryllium (Water Digest)	A-10	A-10
Beryllium (Acid Digest)	A-11	A-11
Bismuth (Water Digest)	A-12	A-11
Bismuth (Acid Digest)	A-13	A-11
Boron (Water Digest)	A-14	A-12
Boron (Acid Digest)	A-15	A-12
Cadmium (Water Digest)	A-16	A-12
Cadmium (Acid Digest)	A-17	A-13
Calcium (Water Digest)	A-18	A-13
Calcium (Acid Digest)	A-19	A-13
Cerium (Water Digest)	A-20	A-14
Cerium (Acid Digest)	A-21	A-14
Chromium (Water Digest)	A-22	A-14
Chromium (Acid Digest)	A-23	A-15
Cobalt (Water Digest)	A-24	A-15
Cobalt (Acid Digest)	A-25	A-15
Copper (Water Digest)	A-26	A-16
Copper (Acid Digest)	A-27	A-16
Iron (Water Digest)	A-28	A-16
Iron (Acid Digest)	A-29	A-17
Lanthanum (Water Digest)	A-30	A-17
Lanthanum (Acid Digest)	A-31	A-17
Lead (Water Digest)	A-32	A-18
Lead (Acid Digest)	A-33	A-18

Table A-1. Analyte Data Tables. (3 sheets)

Analyte	Table	Location
Lithium (Water Digest)	A-34	A-18
Lithium (Acid Digest)	A-35	A-19
Magnesium (Water Digest)	A-36	A-19
Magnesium (Acid Digest)	A-37	A-19
Manganese (Water Digest)	A-38	A-20
Manganese (Acid Digest)	A-39	A-20
Molybdenum (Water Digest)	A-40	A-20
Molybdenum (Acid Digest)	A-41	A-21
Neodymium (Water Digest)	A-42	A-21
Neodymium (Acid Digest)	A-43	A-21
Nickel (Water Digest)	A-44	A-22
Nickel (Acid Digest)	A-45	A-22
Phosphorus (Water Digest)	A-46	A-22
Phosphorus (Acid Digest)	A-47	A-23
Potassium (Water Digest)	A-48	A-23
Potassium (Acid Digest)	A-49	A-23
Samarium (Water Digest)	A-50	A-24
Samarium (Acid Digest)	A-51	A-24
Selenium (Water Digest)	A-52	A-24
Selenium (Acid Digest)	A-53	A-25
Silicon (Water Digest)	A-54	A-25
Silicon (Acid Digest)	A-55	A-25
Silver (Water Digest)	A-56	A-26
Silver (Acid Digest)	A-57	A-26
Sodium (Water Digest)	A-58	A-26
Sodium (Acid Digest)	A-59	A-27
Strontium (Water Digest)	A-60	A-27
Strontium (Acid Digest)	A-61	A-27
Sulfur (Water Digest)	A-62	A-28
Sulfur (Acid Digest)	A-63	A-28
Titanium (Water Digest)	A-64	A-28
Titanium (Acid Digest)	A-65	A-29

Table A-1. Analyte Data Tables. (3 sheets)

Analyte	Table	Location
Thallium (Water Digest)	A-66	A-29
Thallium (Acid Digest)	A-67	A-29
Uranium (Water Digest)	A-68	A-30
Uranium (Acid Digest)	A-69	A-30
Vanadium (Water Digest)	A-70	A-30
Vanadium (Acid Digest)	A-71	A-31
Zinc (Water Digest)	A-72	A-31
Zinc (Acid Digest)	A-73	A-31
Zirconium (Water Digest)	A-74	A-32
Zirconium (Acid Digest)	A-75	A-32
Bromide	A-76	A-32
Chloride	A-77	A-33
Fluoride	A-78	A-33
Nitrite	A-79	A-34
Nitrate	A-80	A-34
Phosphate	A-81	A-34
Sulfate	A-82	A-34
Total Alpha (Digested Solid)	A-83	A-35
Americium-241	A-84	A-35
Cobalt-60	A-85	A-35
Cesium-137	A-86	A-36
Europium-154	A-87	A-36
Europium-155	A-88	A-36
Percent Water	A-89	A-37
Specific Gravity Solids/Sludges	A-90	A-37

Table A-2. Tank 241-T-108 Analytical Results: Aluminum (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 49.3097	< 48.8281	< 49.0689	507	90.4	203
1339	37	Whole	960.3	970.3	965.3			

Table A-3. Tank 241-T-108 Analytical Results: Aluminum (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	246.5	301.0	273.8[c,e]	2,290	88.0	915
1403	37	Whole	4,240	4,370	4,310			

Table A-4. Tank 241-T-108 Analytical Results: Antimony (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 197.2387	< 195.312	< 196.275	< 196	N/A	< 78.3
1339	37	Whole	< 194.9888	< 196.001	< 195.495			

Table A-5. Tank 241-T-108 Analytical Results: Antimony (Acid Digest).

Sample Number	Auger	Auger Portion	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (Mean) %	Projected Inventory kg
1402	35	Whole	< 119.14	< 118.900	< 119.02[a, c]	< 159	N/A	< 63.5
1403	37	Whole	< 199	< 199.880	< 199[a]			

Table A-6. Tank 241-T-108 Analytical Results: Arsenic (Water Digest).

Sample Number	Auger	Auger Portion	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (Mean) %	Projected Inventory kg
1338	35	Whole	< 49.3097	< 48.8281	< 49.0689	< 49.0	N/A	< 19.6
1339	37	Whole	< 48.7472	< 49.0004	< 48.8738			

Table A-7. Tank 241-T-108 Analytical Results: Arsenic (Acid Digest).

Sample Number	Auger	Auger Portion	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (Mean) %	Projected Inventory kg
1402	35	Whole	< 29.785	< 29.7250	< 29.755[c]	< 39.8	N/A	< 15.9
1403	37	Whole	< 49.75	< 49.9700	< 49.86			

Table A-8. Tank 241-T-108 Analytical Results: Barium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1338	35	Whole	< 49.3097	< 48.8281	< 49.0689	< 49.0	N/A	< 19.6
1339	37	Whole	< 48.7472	< 49.0004	< 48.8738			

Table A-9. Tank 241-T-108 Analytical Results: Barium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1402	35	Whole	< 29.785	< 29.7250	< 29.755[c]	< 39.8	N/A	< 15.9
1403	37	Whole	< 49.75	< 49.9700	< 49.86			

Table A-10. Tank 241-T-108 Analytical Results: Beryllium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1338	35	Whole	< 4.9310	< 4.8828	< 4.9069	< 4.90	N/A	< 1.96
1339	37	Whole	< 4.8747	< 4.9000	< 4.8874			

Table A-11. Tank 241-T-108 Analytical Results: Beryllium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 2.9785	< 2.9725	< 2.9755[c]	< 3.98	N/A	< 1.59
1403	37	Whole	< 4.975	< 4.9970	< 4.986			

Table A-12. Tank 241-T-108 Analytical Results: Bismuth (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 98.6193	< 97.6563	< 98.1378	< 97.9	N/A	< 3.91
1339	37	Whole	< 97.4944	< 98.0008	< 97.7476			

Table A-13. Tank 241-T-108 Analytical Results: Bismuth (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	95.13	103.3	99.21[a, c]	605	84.0	242
1403	37	Whole	1,130	1,100	1,110[a]			

Table A-14. Tank 241-T-108 Analytical Results: Boron (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 49.3097	< 48.8281	< 49.0689	< 49.0	N/A	< 19.6
1339	37	Whole	< 48.7472	< 49.0004	< 48.8738			

Table A-15. Tank 241-T-108 Analytical Results: Boron (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 29.785	42.99	36.39[b]	193	80.9	77.1
1403	37	Whole	351.5	346.2	348.9[b]			

Table A-16. Tank 241-T-108 Analytical Results: Cadmium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 9.8619	< 9.7656	< 9.8138	< 9.79	N/A	< 3.91
1339	37	Whole	< 9.7494	< 9.8001	< 9.7748			

Table A-17. Tank 241-T-108 Analytical Results: Cadmium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35:1	Whole	< 5.957	< 5.9450	< 5.951[c]	< 7.96	N/A	< 3.18
1403	37	Whole	< 9.95	< 9.9940	< 9.97			

Table A-18. Tank 241-T-108 Analytical Results: Calcium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 98.6193	< 97.6563	< 98.1378	< 97.9	N/A	< 39.1
1339	37	Whole	< 97.4944	< 98.0008	< 97.7476			

Table A-19. Tank 241-T-108 Analytical Results: Calcium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	84.56	89.67	87.11[c]	177	50.7	70.7
1403	37	Whole	245.9	287.6	266.8[c]			

Table A-20. Tank 241-T-108 Analytical Results: Cerium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 98.6193	< 97.6563	< 98.1378	< 97.9	N/A	< 39.1
1339	37	Whole	< 97.4944	< 98.0008	< 97.7476			

Table A-21. Tank 241-T-108 Analytical Results: Cerium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 59.57	< 59.4500	< 59.51[c]	< 79.6	N/A	< 31.8
1403	37	Whole	< 99.5	< 99.9400	< 99.7			

Table A-22. Tank 241-T-108 Analytical Results: Chromium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 9.8619	< 9.7656	< 9.8138	< 9.88	N/A	< 3.95
1339	37	Whole	10.08	< 9.8001	< 9.94			

Table A-23. Tank 241-T-108 Analytical Results: Chromium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 5.957	< 5.9450	< 5.951[c]	19.2	69.1	7.67
1403	37	Whole	31.17	33.79	32.48			

Table A-24. Tank 241-T-108 Analytical Results: Cobalt (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 19.7239	< 19.5313	< 19.6276	< 19.6	N/A	< 7.83
1339	37	Whole	< 19.4989	< 19.6002	< 19.5496			

Table A-25. Tank 241-T-108 Analytical Results: Cobalt (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 11.914	< 11.8900	< 11.902[c]	< 15.9	N/A	< 6.35
1403	37	Whole	< 19.9	< 19.9880	< 19.9			

Table A-26. Tank 241-T-108 Analytical Results: Copper (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 9.8619	< 9.7656	< 9.8138	< 9.79	N/A	< 3.91
1339	37	Whole	< 9.7494	< 9.8001	< 9.7748			

Table A-27. Tank 241-T-108 Analytical Results: Copper (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 5.957	< 5.9450	< 5.951[c]	< 7.96	N/A	< 3.18
1403	37	Whole	< 9.95	< 9.9940	< 9.97			

Table A-28. Tank 241-T-108 Analytical Results: Iron (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 49.3097	< 48.8281	< 49.0689	71.5	31.4	28.6
1339	37	Whole	82.54	105.5	94.02[c]			

Table A-29. Tank 241-T-108 Analytical Results: Iron (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	619.2	629.4	624.3[c]	6,110	89.3	2,440
1403	37	Whole	12,000	11,100	11,600			

Table A-30. Tank 241-T-108 Analytical Results: Lanthanum (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 49.3097	< 48.8281	< 49.0689	< 49.0	N/A	< 19.6
1339	37	Whole	< 48.7472	< 49.0004	< 48.8738			

Table A-31. Tank 241-T-108 Analytical Results: Lanthanum (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 29.785	< 29.7250	< 29.755[c]	< 39.8	N/A	< 15.9
1403	37	Whole	< 49.75	< 49.9700	< 49.86			

Table A-32. Tank 241-T-108 Analytical Results: Lead (Water Digest).

Sample Number	Auger	Auger Portion	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (Mean) %	Projected Inventory kg
1338	35	Whole	< 98.6193	< 97.6563	< 98.1378	< 97.9	N/A	< 39.1
1339	37	Whole	< 97.4944	< 98.0008	< 97.7476			

Table A-33. Tank 241-T-108 Analytical Results: Lead (Acid Digest).

Sample Number	Auger	Auger Portion	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (Mean) %	Projected Inventory kg
1402	35	Whole	84.45	107.4	95.92[c,e]	533	81.9	213
1403	37	Whole	1,020	918.7	970.0[c]			

Table A-34. Tank 241-T-108 Analytical Results: Lithium (Water Digest).

Sample Number	Auger	Auger Portion	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (Mean) %	Projected Inventory kg
1338	35	Whole	< 9.8619	< 9.7656	< 9.8138	< 9.79	N/A	< 3.91
1339	37	Whole	< 9.7494	< 9.8001	< 9.7748			

Table A-35. Tank 241-T-108 Analytical Results: Lithium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 5.957	< 5.9450	< 5.951[c]	< 7.96	N/A	< 3.18
1403	37	Whole	< 9.95	< 9.9940	< 9.97			

Table A-36. Tank 241-T-108 Analytical Results: Magnesium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 98.6193	< 97.6563	< 98.1378	< 97.9	N/A	< 39.1
1339	37	Whole	< 97.4944	< 98.0008	< 97.7476			

Table A-37. Tank 241-T-108 Analytical Results: Magnesium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 59.57	< 59.4500	< 59.51[c]	< 79.6	N/A	< 31.8
1403	37	Whole	< 99.5	< 99.9400	< 99.7			

Table A-38. Tank 241-T-108 Analytical Results: Manganese (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 9.8619	< 9.7656	< 9.8138	< 9.79	N/A	< 3.91
1339	37	Whole	< 9.7494	< 9.8001	< 9.7748			

Table A-39. Tank 241-T-108 Analytical Results: Manganese (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	85.10	92.90	89.00[c]	182	51.0	72.7
1403	37	Whole	281.8	267.6	274.7			

Table A-40. Tank 241-T-108 Analytical Results: Molybdenum (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 49.3097	< 48.8281	< 49.0689	< 49.0	N/A	< 19.6
1339	37	Whole	< 48.7472	< 49.0004	< 48.8738			

Table A-41. Tank 241-T-108 Analytical Results: Molybdenum (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1402	35	Whole	< 29.785	< 29.7250	< 29.755[c]	< 39.8	N/A	< 15.9
1403	37	Whole	< 49.75	< 49.9700	< 49.86			

Table A-42. Tank 241-T-108 Analytical Results: Neodymium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1338	35	Whole	< 98.6193	< 97.6563	< 98.1378	< 97.9	N/A	< 39.1
1339	37	Whole	< 97.4944	< 98.0008	< 97.7476			

Table A-43. Tank 241-T-108 Analytical Results: Neodymium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1402	35	Whole	< 59.57	< 59.4500	< 59.51[c]	< 79.6	N/A	< 31.8
1403	37	Whole	< 99.5	< 99.9400	< 99.7			

Table A-44. Tank 241-T-108 Analytical Results: Nickel (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 19.7239	< 19.5313	< 19.6276	< 19.6	N/A	< 7.83
1339	37	Whole	< 19.4989	< 19.6002	< 19.5496			

Table A-45. Tank 241-T-108 Analytical Results: Nickel (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 11.914	< 11.8900	< 11.902[c]	< 15.9	N/A	< 6.35
1403	37	Whole	< 19.9	< 19.9880	< 19.9			

Table A-46. Tank 241-T-108 Analytical Results: Phosphorus (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	4,170	3,810	3,990[c]	18,700	78.6	7,470
1339	37	Whole	33,600	33,200	33,400[d]			

Table A-47. Tank 241-T-108 Analytical Results: Phosphorus (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1402	35	Whole	2,160	6,300	4,230[a,c,e]	37,400	88.7	14,900
1403	37	Whole	71,700	69,500	70,600[c,e]			

Table A-48. Tank 241-T-108 Analytical Results: Potassium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1338	35	Whole	< 295.8580	< 292.968	< 294.424	< 294	N/A	< 117
1339	37	Whole	< 292.4832	< 294.002	< 293.243			

Table A-49. Tank 241-T-108 Analytical Results: Potassium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1402	35	Whole	< 178.71	< 178.350	< 178.53	< 239	N/A	< 95.5
1403	37	Whole	< 298.5	299.820	< 299.2			

Table A-50. Tank 241-T-108 Analytical Results: Samarium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 98.6193	< 97.6563	< 98.1378	< 97.9	N/A	< 39.1
1339	37	Whole	< 97.4944	< 98.0008	< 97.7476			

Table A-51. Tank 241-T-108 Analytical Results: Samarium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 59.57	< 59.4500	< 59.51[c]	< 79.6	N/A	< 31.8
1403	37	Whole	< 99.5	< 99.9400	< 99.7			

Table A-52. Tank 241-T-108 Analytical Results: Selenium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 98.6193	< 97.6563	< 98.1378	< 97.9	N/A	< 39.1
1339	37	Whole	< 97.4944	< 98.0008	< 97.7476			

Table A-53. Tank 241-T-108 Analytical Results: Selenium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 59.57	< 59.4500	< 59.51	< 79.6	N/A	< 31.8
1403	37	Whole	< 99.5	< 99.9400	< 99.7[c]			

Table A-54. Tank 241-T-108 Analytical Results: Silicon (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	304.9	256.8	280.9[c]	177	58.6	70.7
1339	37	Whole	69.37	77.13	73.25[c]			

Table A-55. Tank 241-T-108 Analytical Results: Silicon (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	60.81	157.0	108.9[b,d,e]	1,500	93.0	599
1403	37	Whole	2,990	2,810	2,900[b]			

Table A-56. Tank 241-T-108 Analytical Results: Silver (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 9.8619	< 9.7656	< 9.8138	< 9.79	N/A	< 3.91
1339	37	Whole	< 9.7494	< 9.8001	< 9.7748			

Table A-57. Tank 241-T-108 Analytical Results: Silver (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 5.957	< 5.9450	< 5.951[a,c]	< 7.96	N/A	< 3.18
1403	37	Whole	< 9.95	< 9.9940	< 9.97[c,c]			

Table A-58. Tank 241-T-108 Analytical Results: Sodium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	1.21E+05	1.23E+05	1.22E+05[c]	1.11E+05	10.3	44,300
1339	37	Whole	98,400	99,700	99,100			

Table A-59. Tank 241-T-108 Analytical Results: Sodium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	2.47E+05	2.45E+05	2.46E+05[b,c]	2.23E+05	10.2	89,100
1403	37	Whole	2.01E+05	2.00E+05	2.00E+05[b,c]			

Table A-60. Tank 241-T-108 Analytical Results: Strontium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 9.8619	< 9.7656	< 9.8138	< 9.79	N/A	< 3.91
1339	37	Whole	< 9.7494	< 9.8001	< 9.7748			

Table A-61. Tank 241-T-108 Analytical Results: Strontium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 5.957	< 5.9450	< 5.951[c]	21.6	72.4	8.63
1403	37	Whole	35.61	38.87	37.24			

Table A-62. Tank 241-T-108 Analytical Results: Sulfur (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1338	35	Whole	< 49.3097	< 48.8281	< 49.0689	145	66.4	57.9
1339	37	Whole	240.9	242.1	241.5			

Table A-63. Tank 241-T-108 Analytical Results: Sulfur (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1402	35	Whole	73.95	75.11	74.53[a,c]	371	80.0	148
1403	37	Whole	849.8	485.8	667.8			

Table A-64. Tank 241-T-108 Analytical Results: Titanium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1338	35	Whole	< 9.8619	< 9.7656	< 9.8138	< 9.79	N/A	< 3.91
1339	37	Whole	< 9.7494	< 9.8001	< 9.7748			

Table A-65. Tank 241-T-108 Analytical Results: Titanium (Acid Digest).

Sample Number	Auger	Auger Portion	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (Mean) %	Projected Inventory kg
1402	35	Whole	< 5.957	< 5.9450	< 5.956[c]	< 7.96	N/A	< 3.18
1403	37	Whole	< 9.95	< 9.9940	< 9.97			

Table A-66. Tank 241-T-108 Analytical Results:. Thallium (Water Digest).

Sample Number	Auger	Auger Portion	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (Mean) %	Projected Inventory kg
1338	35	Whole	< 197.2387	< 195.312	< 196.275	< 196	N/A	< 78.3
1339	37	Whole	< 194.9888	< 196.001	< 195.495			

Table A-67. Tank 241-T-108 Analytical Results: Thallium (Acid Digest).

Sample Number	Auger	Auger Portion	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (Mean) %	Projected Inventory kg
1402	35	Whole	< 119.14	< 118.900	< 119.02[c]	< 159	N/A	< 63.5
1403	37	Whole	< 199	< 199.880	< 199			

Table A-68. Tank 241-T-108 Analytical Results: Uranium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 394.4773	< 390.625	< 392.551	633	38.0	253
1339	37	Whole	931.6	814.9	873.2[c]			

Table A-69. Tank 241-T-108 Analytical Results: Uranium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 238.28	< 237.800	< 238.04[c]	1,130	79.3	451
1403	37	Whole	1,990	2,070	2,030			

Table A-70. Tank 241-T-108 Analytical Results: Vanadium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 49.3097	< 48.8281	< 49.0689	< 49.0	N/A	< 19.6
1339	37	Whole	< 48.7472	< 49.0004	< 48.8738[c]			

Table A-71. Tank 241-T-108 Analytical Results: Vanadium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 29.785	< 29.7250	< 29.755[c]	< 39.8	N/A	< 15.9
1403	37	Whole	< 49.75	< 49.9700	< 49.86			

Table A-72. Tank 241-T-108 Analytical Results: Zinc (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	13.74	10.48	12.11[c]	13.5	10.3	5.39
1339	37	Whole	14.31	15.46	14.89			

Table A-73. Tank 241-T-108 Analytical Results: Zinc (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	24.91	25.27	25.09[a,c]	52.6	52.2	21.0
1403	37	Whole	73.20	86.84	80.02[a,c]			

Table A-74. Tank 241-T-108 Analytical Results: Zirconium (Water Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 9.8619	< 9.7656	< 9.8138	< 9.79	N/A	3.91
1339	37	Whole	< 9.7494	< 9.8001	< 9.7748			

Table A-75. Tank 241-T-108 Analytical Results: Zirconium (Acid Digest).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1402	35	Whole	< 5.957	< 5.9450	< 5.951[c]	10.9	45.4	4.35
1403	37	Whole	16.11	15.59	15.85			

Table A-76. Tank 241-T-108 Analytical Results: Bromide.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 12,500	< 12,500	< 12,500	< 6,900	N/A	< 2,760
1339	37	Whole	< 1,290	< 1,300	< 1,300			

Table A-77. Tank 241-T-108 Analytical Results: Chloride.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 1,650	< 1,630	< 1,640	< 905	N/A	< 362
1339	37	Whole	< 170	< 170	< 170			

Table A-78. Tank 241-T-108 Analytical Results: Fluoride.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 1,230	< 1,210	< 1,220	10,700	88.7	4,270
1339	37	Whole	19,800	20,600	20,200			

Table A-79. Tank 241-T-108 Analytical Results: Nitrite.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 10,800	< 10,700	< 10,800	6,210[1]	73.8	2,480
1339	37	Whole	1610	1620	1620			

Note:

[1]Estimated overall mean is questionable due to high sample dilution for auger 35 results.

Table A-80. Tank 241-T-108 Analytical Results: Nitrate.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	6.74E+05	6.90E+05	6.82E+05	3.92E+05	73.9	1.57E+05
1339	37	Whole	1.09E+05	95,600	1.02E+05[e]			

Table A-81. Tank 241-T-108 Analytical Results: Phosphate.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	26,100	24,700	25,400	1.25E+05	79.6	49,900
1339	37	Whole	2.18E+05	2.31E+05	2.24E+05			

Table A-82. Tank 241-T-108 Analytical Results: Sulfate.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1338	35	Whole	< 13,400	< 13,300	< 13,400[1]	7,430	80.0	2,970
1339	37	Whole	1400	1520	1460			

Note:

[1]Estimated overall mean is questionable due to high sample dilution for auger 35 results.

Table A-83. Tank 241-T-108 Analytical Results: Total Alpha (Digested Solid).

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
1321	35	Whole	0.0520	0.0389	0.0454[b,c,e]	0.0702	35.2	28.0
1324	37	Whole	0.115	0.0747	0.0949[c,e]			

Table A-84. Tank 241-T-108 Analytical Results: Americium-241.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
1321	35	Whole	< 0.0930	< 0.0815	< 0.0873	< 0.123	N/A	< 49.1
1324	37	Whole	< 0.172	< 0.144	< 0.158			

Table A-85. Tank 241-T-108 Analytical Results: Cobalt-60.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
1321	35	Whole	< 0.0136	< 0.0127	< 0.0132	< 0.0133	N/A	< 5.31
1324	37	Whole	< 0.0139	< 0.0128	< 0.0134			

Table A-86. Tank 241-T-108 Analytical Results: Cesium-137.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
1321	35	Whole	0.619	0.625	0.622	2.00	69.0	799
1324	37	Whole	3.770	2.990	3.380[c]			

Table A-87. Tank 241-T-108 Analytical Results: Europium-154.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
1321	35	Whole	< 0.0446	< 0.0368	< 0.0407	< 0.0455	N/A	<18.2
1324	37	Whole	< 0.0527	< 0.0479	< 0.0503			

Table A-88. Tank 241-T-108 Analytical Results: Europium-155.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
1321	35	Whole	< 0.0292	< 0.0288	< 0.0290	< 0.0407	N/A	< 16.3
1324	37	Whole	< 0.0555	< 0.0490	< 0.0523			

Table A-89. Tank 241-T-108 Analytical Results: Percent Water.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean)	Projected Inventory
			%	%	%	%	%	kg
1320[1]	35	Whole	0.540	1.120	0.830[e]	19.5	105	N/A
1320[2]	35	Whole	4.320	0.770	2.545[e]			
1323[2]	37	Whole	35.93	38.68	37.30			

Notes:

[1]Percent water by thermogravimetric analysis using a Perkin-Elmer instrument.

[2]Percent water by thermogravimetric analysis using a Mettler instrument.

Table A-90. Tank 241-T-108 Analytical Results: Specific Gravity Solid/Sludges.

Sample Number	Auger	Auger Portion	Result	Duplicate	Mean	Overall Mean	RSD (Mean) %	Projected Inventory
1320	35	Whole	2.640	1.950	2.295[e]	2.35	2.1	N/A
1323	37	Whole	2.400	---	2.400			

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To	From	Page 1 of 4
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DISTRIBUTION SHEET

To	From	Page 2 of 4
Distribution	Data Assessment and Interpretation	Date 03/29/96
Project Title/Work Order		EDT No. EDT-615369
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<u>CH2M Hill</u> P. O. Box 91500 Bellevue, WA 98009-2050					
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DISTRIBUTION SHEET

To	From	Page 3 of 4
Distribution	Data Assessment and Interpretation	Date 03/29/96
Project Title/Work Order		EDT No. EDT-615369
Tank Characterization Report for Single-Shell Tank 241-T-108, WHC-SD-WM-ER-554, Rev. 0		ECN No. N/A

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J. S. Garfield	H5-49	X			
J. D. Guberski	R2-06				X
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DISTRIBUTION SHEET

To	From	Page 4 of 4
Distribution	Data Assessment and Interpretation	Date 03/29/96
Project Title/Work Order		EDT No. EDT-615369
Tank Characterization Report for Single-Shell Tank 241-T-108, WHC-SD-WM-ER-554, Rev. 0		ECN No. N/A

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G. D. Johnson	S7-15	X			
K. K. Kawabata	S7-55	X			
T. J. Kelley	S7-21	X			
N. W. Kirch	R2-11	X			
M. J. Kupfer	H5-49	X			
D. L. McGrew	R3-25	X			
J. E. Meacham	S7-15	X			
W. C. Miller	R1-30	X			
C. T. Narquis	T6-16	X			
R. J. Nicklas	R1-43	X			
D. E. Place	H5-27	X			
D. A. Reynolds	R2-11	X			
L. M. Sasaki	R2-12	X			
F. A. Schmittroth	H0-35	X			
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Central Files	A3-88	X			
EDMC	H6-08	X			
ERC (Environmental Resource Center)	R1-51	X			
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